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201 FACILITIES PLAN

ENVIRONMENTAL IMPACT STATEMENT
EXISTING ENVIRONMENT
TECHNICAL REFERENCE DOCUMENT, VOLUME I

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IV
ATLANTA, GEORGIA 30365

i.a

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VOLUME I

EXISTING ENVIRONMENT

Volume I, Existing Environment, includes a description of the present social, economic, and natural environmental features of the Planning Area. In order to evaluate the impacts of the proposed alternative wastewater treatment facilities described in the 201 Plan, the current environmental, or baseline conditions must be known. Volume I will document the natural and manmade features of the area, providing a starting point from which evaluations of alternatives can be made.

The focus of the following discussion is the immediate Planning Area where the proposed actions will occur. However, where appropriate, parts of the surrounding area were also included so that important regional or inter-basin secondary impacts can be assessed.

Local governmental planning agencies, environmental protection groups, citizens, universities and others were very helpful in supplying direction, advice and information during this study.

I.1 DEMOGRAPHY AND ECONOMICS

The socioeconomic baseline for the Planning Area is important primarily to determine growth trends. Hillsborough County and the City of Tampa have a history of substantial growth since 1950. The continuation of these trends would place pressure for development on Hillsborough County. It is necessary to examine the relationship of Hillsborough County to the Tampa Bay Region to determine if these growth trends are likely to continue.

I.1.1 Population

The Tampa Bay Region, consisting of Hillsborough County, Manatee County, Pasco County and Pinellas County, has grown very rapidly since 1950. Indeed it has grown much more rapidly than the United States as a whole (Table I.1-1). This growth, which exceeds national growth by as much as 22 percent, is due primarily to in-migration. The Tampa Bay Region has been and is continuing to expand rapidly. Hillsborough County, which is in the center of the Tampa Bay Region, has followed regional growth. From 1950 to 1960 Hillsborough County expanded by 59 percent and in the following 1960 decade, it expanded by 23 percent. Population is presently expanding at a rate of 76 percent per decade.

Population growth within Hilsborough County has not been uniform. As shown in Table I.1-1 the City of Tampa, which is the major population center in Hilsborough County, grew by 121 percent from 1950 to 1960. Part of the growth reported for the city. Nevertheless, the more than 100 percent growth is substantial. The population of the county, on the other hand, increased by only 59 percent. Obviously, this lower rate of county population growth in comparison to the city growth rate was due to annexation of portions of the county into the city. From 1960 to 1970, the

TABLE I.1-1

POPULATION GROWTH RATES FOR REGION, HILLSBOROUGH COUNTY, AND CITY OF TAMPA

Year	United States	Tampa Bay** Region	Hillsborough County	City of Tampa	Hillsborough County Excluding the City of Tampa
Population					
1950[1]	151,325,798	464,376	249,894	124,681	125,213
1960[1]	179,323,175	878,406	397,788	274,970	122,818
1970[1]	203,211,926	1,185,664	490,265	277,767	213,498
1978	---	--	652,000[2]	309,000	343,000
Percent Growth					
1950 to 1960	19	89	59	121	-2*
1960 to 1970	13	35	23	1	74
1970 to 1978	--	--	33	11	61

* The negative growth is only apparent. The city of Tampa annexed portions of Hillsborough County between 1950 and 1960.

** The Tampa Bay Region is composed of Hillsborough, Manatee, Pasco and Pinellas Counties.

Source: [1] U.S. Census of Population, Florida. 1950, 1960 and 1970.
[2] "Tampa Facts," Committee of 100, Greater Tampa Chamber of Commerce, P.O. Box 420, Tampa, Florida, 33601.

county grew 23 percent, but the City of Tampa grew by only one percent. It appears that from 1960 to 1970 the City of Tampa has peaked its growth and, should grow much slower in the future. That area of the county outside the City of Tampa grew little from 1950 to 1960, but, from 1960 to 1970, it has grown by 74 percent. This is an extremely high growth rate. It amounts to a geometric growth of one percent per year and an approximately 12 year doubling rate.

Future growth trends of the Tampa Bay Region are expected to be high. Table I.1-2 indicates those future growth trends. Between 1970 and 1980, the Tampa Bay Region is expected to increase its population by 50 percent. Growth is expected to slow in the period from 1980 to 1990 to 23 percent, and from 1990 to 2000 to 15 percent. These growth rates are in contrast to 10 percent for the United States projected for 1980 to 1990 and the 7 percent rate projected for 1990 to 2000. In summary, it is expected that considerable migration will continue into the Tampa Bay Region.

Percentage growth, however, can be deceiving. For example, between 1990 and 2000 the Tampa Bay Region is expected to grow by approximately 326,000 people, yet this is only a 15 percent growth rate. However, between 1980 and 1990 the net growth is 400,000 people or a 23 percent increase. Thus, it can be seen that although the growth rate seems to be declining, the actual numerical increase projected for the Tampa Bay Region will still be substantial.

Examination of Hillsborough County shows similar increases. The county is projected to increase by 36 percent between 1970 and 1980, 27 percent between 1980 and 1990, and 21 percent between 1990 and 2000. However, the population of 1,000,000 projected for year 2000 is just over a

TABLE I.1-2

FUTURE GROWTH TRENDS

Year	Tampa Bay Region	Hillsborough[1] County	City of[2] Tampa	Hillsborough County Excluding the City of Tampa
Population				
1970	1,185,664	490,265	277,767	212,498
1980	1,784,200	665,816	316,845	348,971
1985	2,004,400	757,196	336,384	420,812
1990	2,189,800	848,346	355,922	492,424
2000	2,516,400	1,029,961	395,000	634,961
Percent Change				
1970 to 1980	50	36	14	64
1980 to 1990	23	27	12	41
1990 to 2000	15	21	11	29

Source: [1] Hillsborough County Planning Commission 1980
[2] Greeley & Hansen and Smith & Gillespie, 1979a

doubling of the 1970 population. Of this 539,700 person growth, only about 120,000 will be in the City of Tampa. As can be seen in Table I.1-2, the City of Tampa will increase, although at a much slower rate than the county. In terms of numbers of people the city has a smaller base. Growth within the city will be accomplished by increasing the population density within the city. One can expect that the remainder of the county will increase by approximately 420,000 people. In effect the Planning Area will handle the majority of this 300,000 person increase.

These growth trends indicate that if the City of Tampa and Hillsborough County follow the past trends, population will continue to increase substantially. Further, the indication is that the vast bulk of the growth, almost three quarters of the expected growth in the county, will occur outside the City of Tampa.

I.1.2 Population Characteristics

There are certain characteristics of the projected population which bear examination. In order to analyze the driving force for the City of Tampa and its future trends, it is necessary to determine whether Hillsborough County is, in fact, characteristic of the Tampa Bay Region. Table I.1-3, for example, provides a summary of population characteristics for the Tampa Bay Region, Hillsborough County and the City of Tampa. The United States and Florida characteristics are included to provide a point of reference.

Examination of Table I.1-3 indicates that Hillsborough County characteristics differ from the Tampa Bay Region primarily in age distribution. Twenty-two percent of the Tampa Bay Region population is over 65. While, in Hillsborough County, only 10 percent of the population is over 65. When one excludes Hillsborough County from the Tampa Bay Region and

TABLE I.1-3

1970 POPULATION CHARACTERISTICS

Characteristic	United States	Florida	Tampa Bay Region	Region Excluding Hillsborough County	Hillsborough	City of Tampa	Hillsboroug County Excluding City of Tam
Total Population	203,211,926	6,789,443	1,185,664	695,399	490,265	277,767	212,498
Age (Percent)							
0 to 18	34	31	27	23	34	31	37
18 to 65	56	54	51	47	56	57	55
65 and Over	10	15	22	30	10	12	8
Race (Percent)							
White	88	84	89	91	86	80	94
Negro	11	15	11	8	14	20	6
Education (Percent)[1]							
No High School	29	28	28	28	29	32	25
High School, 1 to 3 Years	19	20	21	21	22	21	22
High School, 4 Years	31	30	30	30	30	29	31
College, 1 Year or More	21	22	21	21	19	18	22
Occupation[2]							
Professional	15	14	12	14	12	12	12
Managers & Administrators	8	9	10	10	9	8	10
Sales Workers	7	9	10	11	9	9	9
Clerical Workers	17	18	18	17	18	20	18
Craftsmen, Foremen, etc.	14	14	15	14	15	13	16
Operators	18	12	12	11	16	16	16
Laborers	6	8	7	7	7	7	8
Farmers & Farm Managers	2	1	1	-	1	-	1
Service Workers	11	13	13	14	11	13	9
Private Household Workers	2	2	2	2	2	2	1

(Continued)

TABLE I.1-3 (Continued)

Characteristic	United States	Florida	Tampa Bay Region	Region Excluding Hillsborough County	Hillsborough	City of Tampa	Hillsborou County Excluding City of Ta
Population 25 Years and Older	109,899,359	3,967,881	755,409	487,231	268,178	158,353	109,825
Employed Persons, 16 Years and Older	76,553,599	2,426,268	393,308	201,957	181,351	103,742	77,609

[1] Based on populations 25 years and older
[2] Based on employment population 16 years and older

Source: United States Bureau of Census, U.S. Department of Commerce, 1970 examines the other three counties, this difference in age distribution is even more striking. The region, excluding Hillsborough County, has 30 percent of its population age 65 and over. However, Hillsborough County, particularly that portion of the county outside of the City of Tampa, does not resemble the age profile for the region. The conclusion is that, although the region is growing through retirees, Hillsborough County and the City of Tampa cannot be growing because of the same moving force, i.e. in-migration of retirees.

I.1.3 Economic Profile

The City of Tampa and Hillsborough County's economic structure is based upon contract construction, transportation and wholesale and retail trade. While Hillsborough County is a major metropolitan area, its economic importance is established through its relationship to the Tampa Bay Region.

a. **Base Profile**: As shown in the population baseline, the Tampa Bay Region is a center for retirees. These persons move into the area bringing money they have earned elsewhere, making the relocation of retirees a "base" segment of the Tampa Bay economy. As seen in Table I.1-4 the region has location quotients(1) (LQ) greater than 1 for contract construction, wholesale and retail trade, services, banking and financing. Each of these sectors indicates the impact of tourism and retirees, as well as retiree in-migration. The retirees require housing which is reflected in the contract construction sector.

(1) Location Quotient =

$$\frac{\dfrac{\text{No. of employees for industry (i) in area (x)}}{\text{Total No. of employed persons in area (x)}}}{\dfrac{\text{No. of employees for industry (i) in area (y)}}{\text{Total No. of employed persons in area (y)}}}$$

TABLE I.1-4

LOCATION QUOTIENTS FOR HILLSBOROUGH COUNTY AND TAMPA BAY REGION, 1976

SIC	Hillsborough County LQ Nation	 LQ Florida	Region LQ Nation	 LQ Florida	Region Minus Hillsborough County LQ Nation	 LQ Florida	 LQ Florida
Agricultural Services	1.8	0.7	2.0	0.8	2.0	0.8	2.5
Mining	0.2	0.7	0.1	0.3	---	0.1	0.3
Contract Construction	1.5	1.2	1.5	1.2	1.5	1.2	1.3
Manufacturing	0.6	1.2	0.5	1.0	0.4	0.9	0.5
Transportation	1.3	1.1	1.0	0.9	0.8	0.7	1.2
Wholesale Trade	1.5	1.5	1.0	1.0	0.6	0.6	1.0
Retail Trade	1.1	0.9	1.3	1.1	1.5	1.2	1.3
Finance, Insurance, Banking	1.1	0.8	1.2	0.9	1.3	1.0	1.3
Services	1.1	0.9	1.2	1.0	1.3	1.1	1.2
Other	1.5	1.0	1.0	0.7	1.0	0.7	1.5

Source: U.S. Bureau of Census, U.S. Department of Commerce, 1976

The large export LQ for retail and trade reflect the influence of tourism as well as retiree relocation. Wholesale trade, on the other hand, is only self-sufficient for the region. Finally, the economic segment services is an export segment. Services for retirees and tourists result in a larger LQ.

The other sector for the region which is a base sector is agriculture. The LQ of 2 for U.S. base indicates that the citrus and truck farms in the Planning Area are productive, and export more than is consumed locally. Given that Florida is the largest citrus producer in the U.S., such a finding is not unexpected. However, the employment in agriculture for the Planning Area is only 0.8 percent of total employment. Further, as the region grows, it is only citrus groves that are likely to give way to residential development (see Section I.2). Consequently, it is not likely that the agriculture sector will be significant in generating new employment in the region.

Demographic characteristics of Hillsborough County, as shown in Table I.1-4 are not the same as for the region. Differences include:

1. Tampa/Hillsborough County is a transportation center for the region. The Tampa International Airport is a major contribution as is the Port of Tampa. The Port of Tampa is not dependent upon retiree or resort usage.

2. Tampa/Hillsborough County is greater than 1 for both U.S. and Florida reference bases. The region is self sufficient, Tampa/Hillsborough County is an exporter, and the region, minus Hillsborough, is an importer of wholesale trade.

3. Tampa/Hillsborough, compared to Florida, is a manufacturing exporter. The Tampa Bay Region minus Hillsborough, is not an exporter in the manufacturing sector.

4. The Tampa Bay Region, minus Hillsborough County, is a net exporter for retail trade, finance, insurance, banking and services. Tampa/Hillsborough County, however, is not an "exporter" of these services for the Florida reference.

Each of these differences indicate that Tampa/Hillsborough County is the manufacturing/wholesale, trade/transportation center of the Tampa Bay Region. The tourism and retiree migration into the other counties in the region effectively "fuel" the Tampa/Hillsborough economy.

The base multiplier for Hillsborough County is about 2.5. That is, for each job which is created in the export sector, an additional 1.5 jobs are created. However, it should be noted that areas which rely upon services do not generally have as high a multiplier as areas relying upon large scale manufacturing.

Agriculture has historically been important to Hillsborough County. As shown in Table I.1-4 Hillsborough County is still an exporter of goods and services. The main exports are citrus and truck crops. However, as shown in Table I.1-4A the number of farmers and amount of land devoted to agricultural purposes have declined more than 30 percent in the period from 1964 to 1974; a time period in which Hillsborough County experienced rapid growth in population. Unfortunately much of the growth was at the expense of cropland, particularly citrus groves. As seen in Table I.1-4A total cropland decreased by 20 percent and orchards (citrus groves) by 41 percent.

TABLE I.1-4A

AGRICULTURAL TRENDS IN HILLSBOROUGH COUNTY, 1964 TO 1974

Category	1964	1969	1974	Percent Change 1964 to 1974
Number of Farms	3,398	2,769	2,335	-31
Land in Farms	769,245	374,767	358,178	-53
Average Size of Farm	226	135	153	-32
Total Cropland	138,084	117,712	110,943	-20
Land in Orchards	66,591	52,365	39,257	-41

Source: U.S. Census of Agriculture, Florida, 1964, 1969 and 1974.

Citrus groves thrive in areas which are also most suitable for development. Land in agriculture can be expected to decrease as development pressure and population growth continue.

b. Employment: Tampa is a trade center for the region. It is a leading phosphate-shipping port and is involved with citrus canning as well as a shrimp industry. Manufactured products include fabricated steel, electronic equipment, cigars, beer, paint and fertilizers. It is also an education center for the University of South Florida, the University of Tampa, Hillsborough Community College and Florida Southern College. This variety allows a diverse employment structure; the Tampa/Hillsborough economy is the most diverse in the Planning Area.

Tampa/Hillsborough County has its major employment concentrated in contract construction, transportation, wholesale trade and services. Manufacturing is higher than in other counties in the region. Unemployment, which is often seasonal in an economy based upon tourism, is shown in Table I.1-5. Note that the employment rate was relatively high in 1975 and 1976, which in general were recessionary years.

The largest employers in the county are the city and county governments (Table I.1-6). Firms or organizations employing over 1,000 persons constitute a small percentage of total employment. Thus, there are a large number of small firms and organizations which is characteristic of an area dependent upon services or tourism for an economic base.

c. Salaries and Wages: Personal income may be defined as income including wages and salaries, other labor income, proprietor's income, property income and transfer payments. It is the current income of persons in an area from sources, being measured before deduction of income and other personal taxes but after deduction of personal contributions to

TABLE I.1-5

EMPLOYMENT IN RECENT YEARS FOR HILLSBOROUGH COUNTY

	1974	1975	1976	1977	1978
Civilian Labor Force	219,600	227,700	229,900	264,200	270,000
Employment	208,900	203,500	201,100	238,000	252,800
Unemployment	10,700	24,200	28,800	26,200	17,200
Unemployment Rate	4.9	10.6	12.5	9.9	6.4

Source: SMSA Labor Market Trends, State of Florida, Department of Commerce, Division of Employment Security, June 1978. Tampa-St. Petersburg.

TABLE I.1-6

MAJOR EMPLOYERS IN HILLSBOROUGH COUNTY
OCTOBER 1978*

Organization	Number of Employees
Hillsborough County	7,980
City of Tampa	5,790
General Telephone Company	5,390
Tampa Electric Company	2,345
Maas Brothers	2,160
Honeywell, Inc.	1,350
Gardinier, Inc.	1,235
Singleton Packing Corporation	1,065
Florida Mining and Material Corp.	1,000
Westinghouse Corporation	1,000

* The list does not include the University of Tampa, MacDill Air Force Base and University of South Florida which are also major employers.

Source: Committee of 100, Greater Tampa Chamber of Commerce, Tampa, Florida.

social insurance programs. Thus defined, Table I.1-7 shows that Hillsborough County per capita income closely parallels that of the Tampa-St. Petersburg Standard Metropolitan Statistical Area (SMSA). The major sources of personal income for the SMSA were wholesale and retail trade, service industries and manufacturing. All of these sources, when compared to Florida, had location quotients greater than 1.

In terms of dollar volume, wholesale and retail trade dominates the income generated; however, it does not provide the highest income per employee. Manufacturing represents the highest income per employee. Again, this pattern reflects the retiree/tourist orientation of the region.

I.1.4 Economic Projections

The economic growth of the Planning Area and region will remain dependent upon the in-migration of retirees. Such dependency is reflected in Table I.1-8, the projected employment. In preparation of the table, it is assumed that the economic base of the Planning Area will not change significantly.

There are, however, some possible changes which would influence the economic base. The first is an expansion of the phosphate industry in Florida. In 1976 there were only 2,762 persons (1.5 percent of the employment work force) employed by phosphate mining and agricultural chemicals in Hillsborough County. Further, there are 1,339 persons employed in water transportation, which, through the Port of Tampa, handles a substantial amount of phosphate. An expansion of the phosphate industry (both mining and chemical processing) would increase base employment. Considering the amount of land in Hillsborough County owned by phosphate companies, it is possible that they could increase the rate at which the material is mined.

TABLE I.1-7

1975 PERSONAL INCOME ($1,000)

	Hillsborough County		Tampa - St. Petersburg SMSA	
	$1,000	%	$1,000	%
Total Personal Income	2,552,100		4,682,300	
I. Farm Income	46,400	1.8	72,700	1.6
II. Non Farm Income: Total	2,505,700	98.2	4,609,500	98.4
A. Private: Total	2,051,200	81.9	3,814,600	82.8
Manufacturing	349,200	17.0	667,000	17.5
Mining	1,500	0.07	1,500	0.04
Contract Construction	238,400	11.6	442,700	11.1
Wholesale & Retail Trade	581,300	28.3	1,024,200	26.9
Finance, Insurance, and Real Estate	161,500	7.9	331,400	8.7
Transportation, Communications, and Public Utilities	261,700	12.8	389,200	10.2
Services	441,200	21.8	952,000	25.0
Other Private Industry	16,400	0.8	16,400	0.4
B. Government: Total	454,400	18.1	795,000	17.2
Federal		37.9		33.4
Civilian	91,300		159,900	
Military	81,100		106,000	
State and Local	282,100	62.1	529,100	66.0

Source: Greeley & Hansen and Smith & Gillespie, 1979b

TABLE I.1-8

EMPLOYMENT PROJECTIONS FOR HILLSBOROUGH COUNTY

	1980	1985	1990	1995	2000
Agriculture	6,500	7,100	7,600	8,100	8,500
Mining	1,600	1,700	1,900	2,000	2,100
Construction	19,100	20,900	22,400	23,800	25,100
Manufacturing	38,600	42,300	46,200	48,000	50,700
Transportation, Communication, Public Utilities	21,400	23,400	25,000	26,600	28,100
Wholesale and Retail Trade	72,300	79,100	84,700	89,500	94,900
Finance, Insurance, Real Estate	16,000	17,600	18,800	19,900	21,100
Services, Misc.	46,700	51,300	54,900	58,200	61,500
Government	42,800	46,900	50,200	53,200	56,200
Other	28,200	30,900	33,100	35,100	37,000
Total	293,400	321,200	344,800	364,400	385,200

Source: "Areawide Water Quality," Tampa Bay Regional Planning Council, 1978a

Nevertheless, even a doubling of employment in the industry would account, after applying a 2.5 multiplier, for only 3 percent of employment increase by 2,000 (Table I.1-8). As a consequence, changes in the phosphate industry will not have a significant impact upon area employment.

It is more likely that Tampa/Hillsborough County may become more attractive to retirees through developments catering to them. Such an event would change the ratio of employment to population and would generate a need for services in Tampa/Hillsborough County.

I.1.5 Baseline Conclusions

Tampa/Hillsborough County will continue to experience strong development pressure as long as the Tampa Bay Region experiences in-migration of retirees. This influx of people fuels the Tampa/Hillsborough County economy which is based upon wholesale trade, manufacturing, contract construction and transportation. Thus, continued growth in the region will also result in in-migration of persons to Tampa/Hillsborough County who are attracted primarily by economic opportunities. As a consequence, the population profile of Tampa/Hillsborough will continue to diverge from that of the region.

The development pressure resulting from growth will focus on those county areas which have not yet developed. The growth history of Tampa/Hillsborough County has been one of suburban sprawl, and, at this time, there is no strong reason to believe that the pattern of development pressure will change. As such, existing land use, zoning and comprehensive planning will be important in shaping local growth patterns (see Volume I.2).

The implications of growth for this study are strongest for the "No Action" alternative. The population projections and the comprehensive plan (the Horizon 2000 Plan) each assume continued pressure for development; however, the Horizon 2000 Plan assumes that some type of sewerage system will be present. The present study assumes that the pressures for growth in the Planning Area will continue with or without a sewerage system. The changes that occur will be in terms of environmental impact and patterns of development.

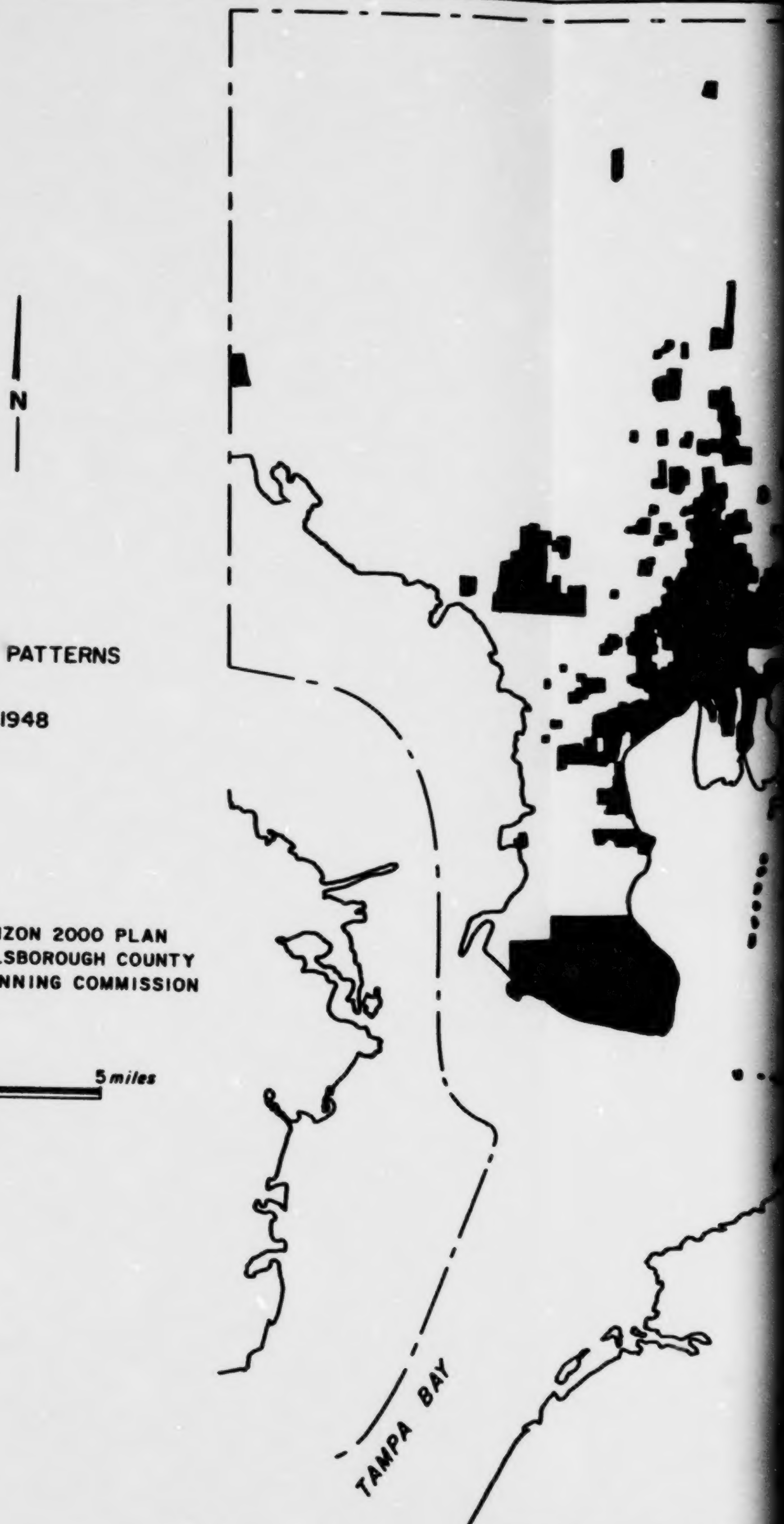
I.2 LAND USE

For this study, the land analysis of the Planning Area delineates urban development patterns and areas of environmental or economic sensitivity. The Planning Area's land use patterns have been strongly influenced by the high growth experienced since 1950 which has made large scale residential development projects economically feasible. In Tampa/Hillsborough County such development has resulted in suburban sprawl.

This section will examine the historic growth trends of Hillsborough County.

I.2.1 Urban Development Patterns

Figures I.2-1, I.2-2 and I.2-3 indicate the areal extent of urban development in Hillsborough County during three historical time periods; 1948, 1948-1972 and 1972-1976. Urban development in 1948 was centered north of Hillsborough Bay in the vicinity of what is at present the Central Business District (CBD) of Tampa. Between 1948 and 1972 urban development in Hillsborough County had more than doubled and had spread outward from the existing city core. Thus, the main development occurred north, southwest and east of its original location. The small area southeast of the original city core on the eastern edge of Hillsborough County had remained relatively free of development. Between 1972 and 1976 development occurred around the existing urban perimeter and showed definite trends of advancing northward and eastward of its present limits. Advancement of urban development from the original city areas has been a process of outlying areas developing in isolation from existing urban development with subsequent development filling in the vacant areas. The trend seems to have accelerated between 1972 and 1976 since, in relation to



DEVELOPMENT PATTERNS

▇ 1948

SOURCE: HORIZON 2000 PLAN
HILLSBOROUGH COUNTY
PLANNING COMMISSION

CENTRAL HILLSBOROUGH COUNTY-TAMPA
201 FACILITY PLAN
ENVIRONMENTAL REPORT
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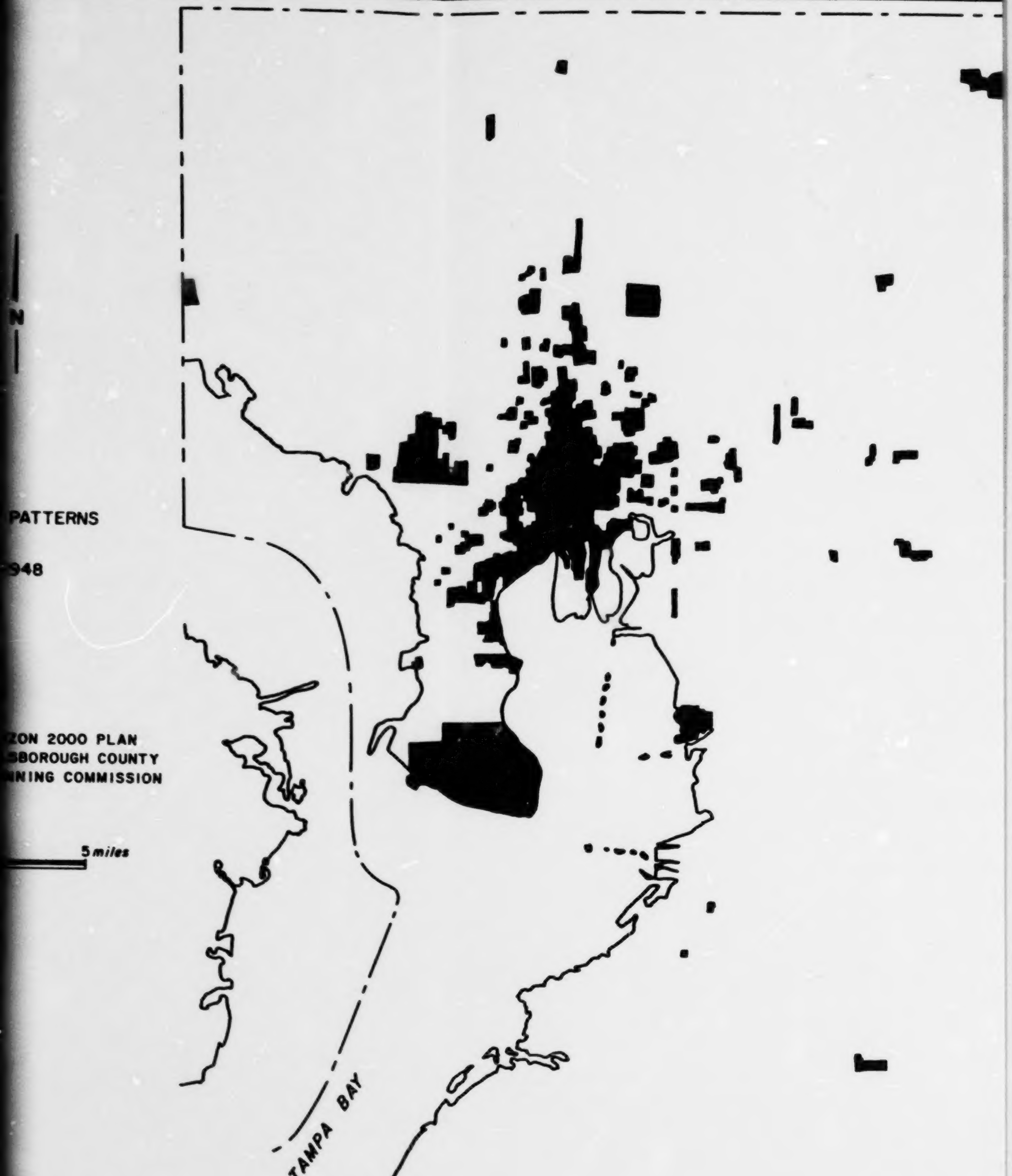
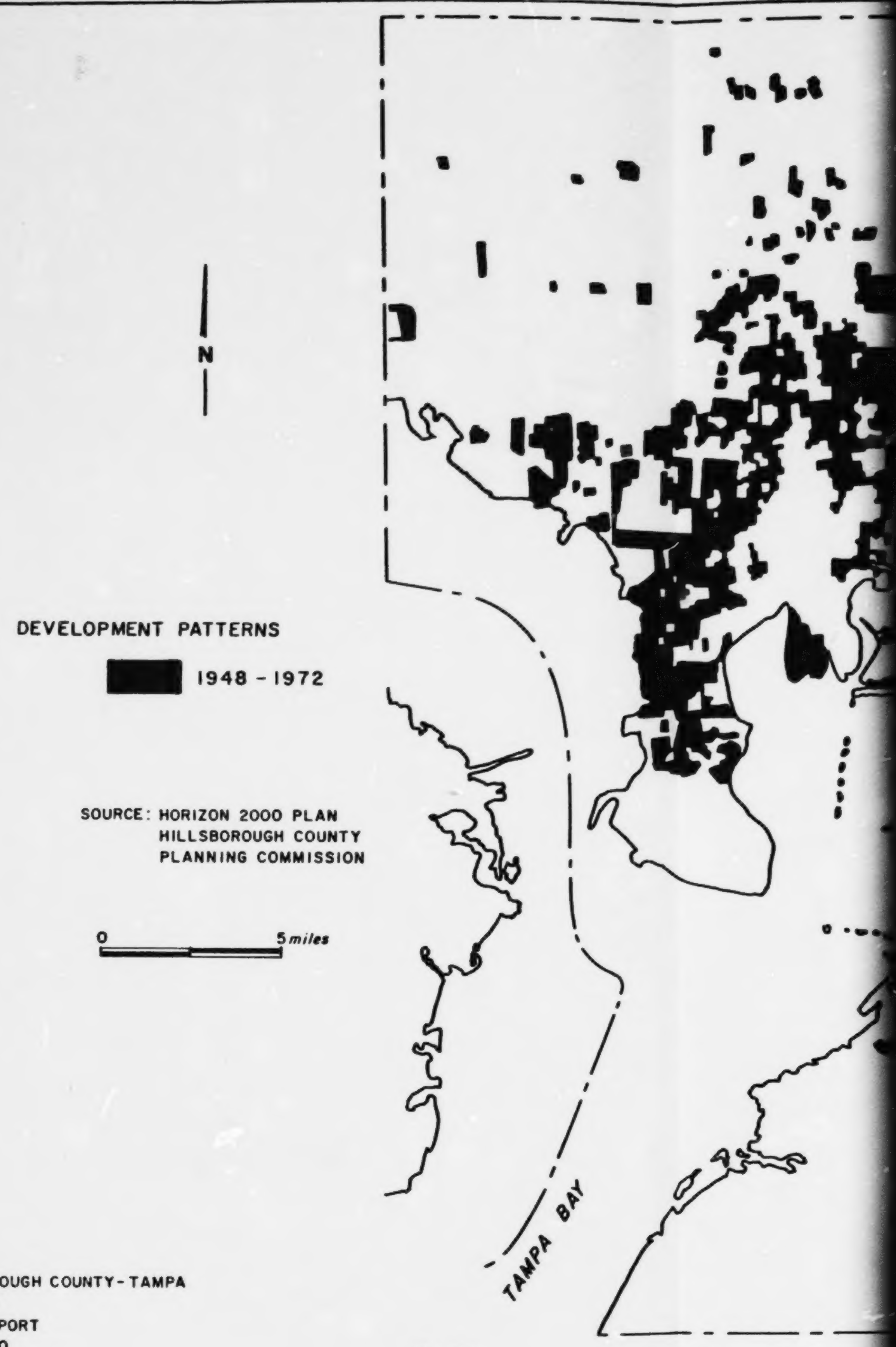
PATTERNS

948

ZON 2000 PLAN
SBOROUGH COUNTY
NNING COMMISSION


N
5 miles
TAMPA BAY

DAMES & MOORE
FIGURE I.2-1


N
DEVELOPMENT PATTERNS
■ 1948 - 1972
SOURCE: HORIZON 2000 PLAN
HILLSBOROUGH COUNTY
PLANNING COMMISSION
0
5 miles
TAMPA BAY

CENTRAL HILLSBOROUGH COUNTY-TAMPA
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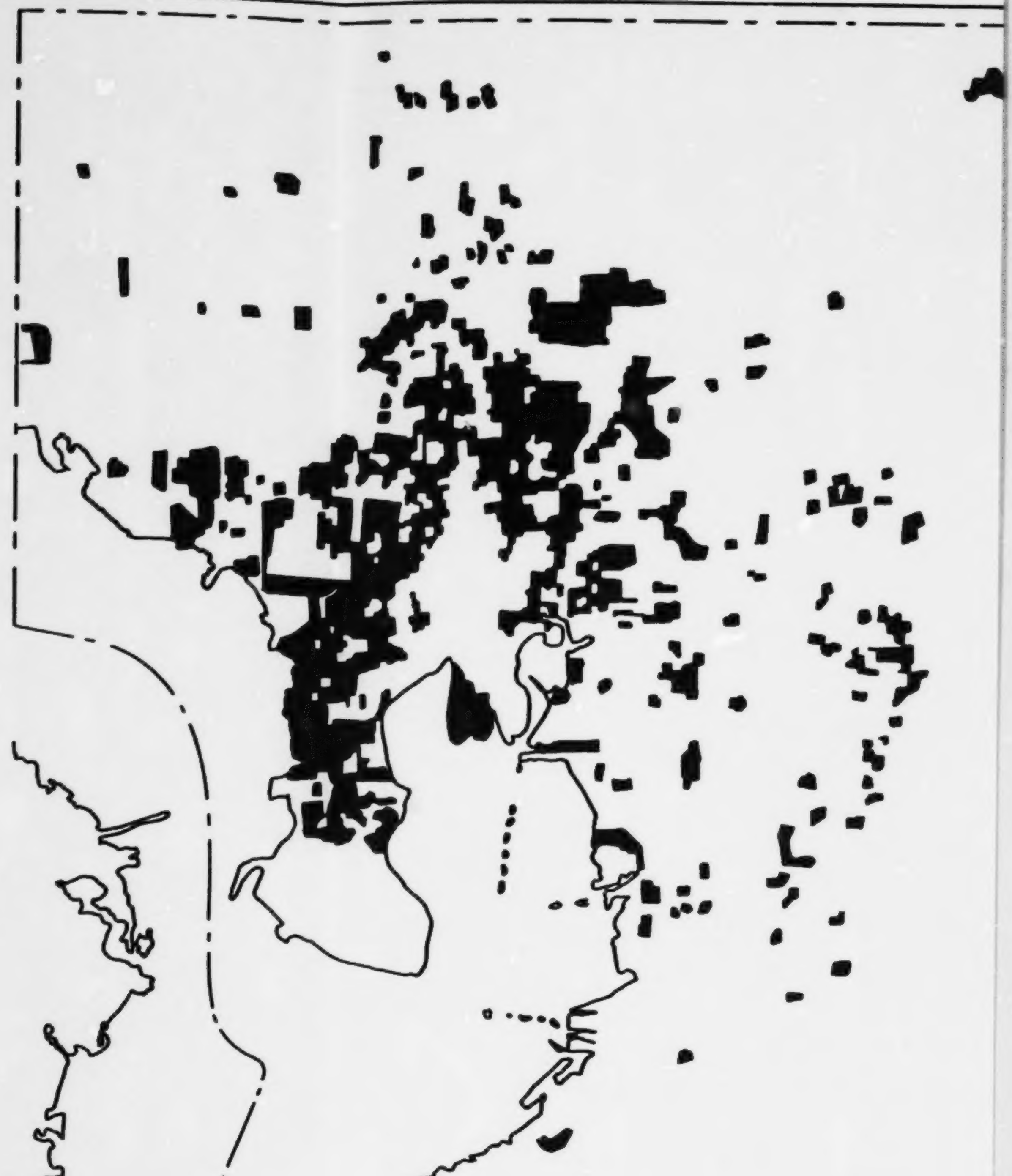
TTERNS

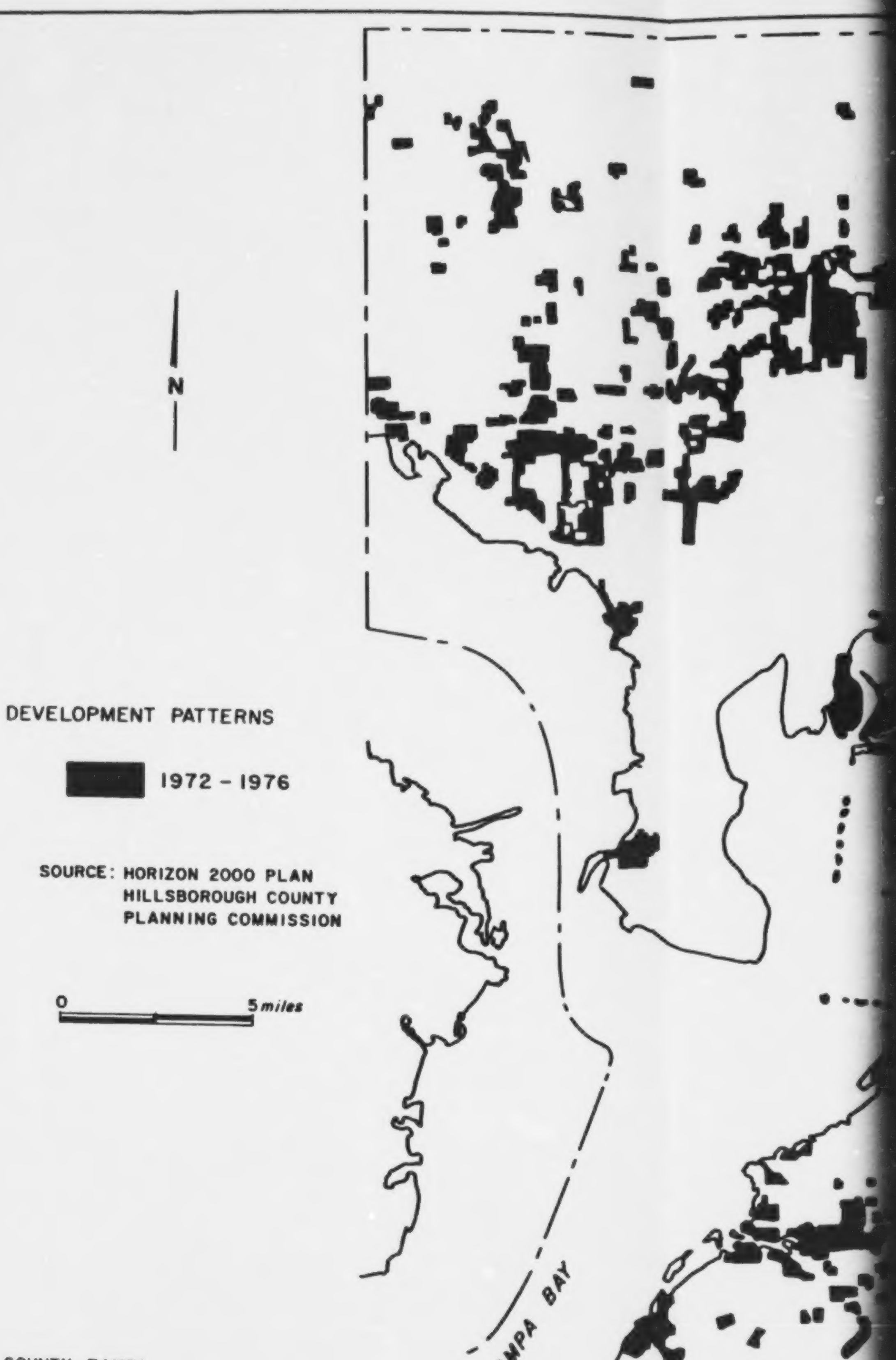
1948 - 1972

ZON 2000 PLAN
SBOROUGH COUNTY
NNING COMMISSION

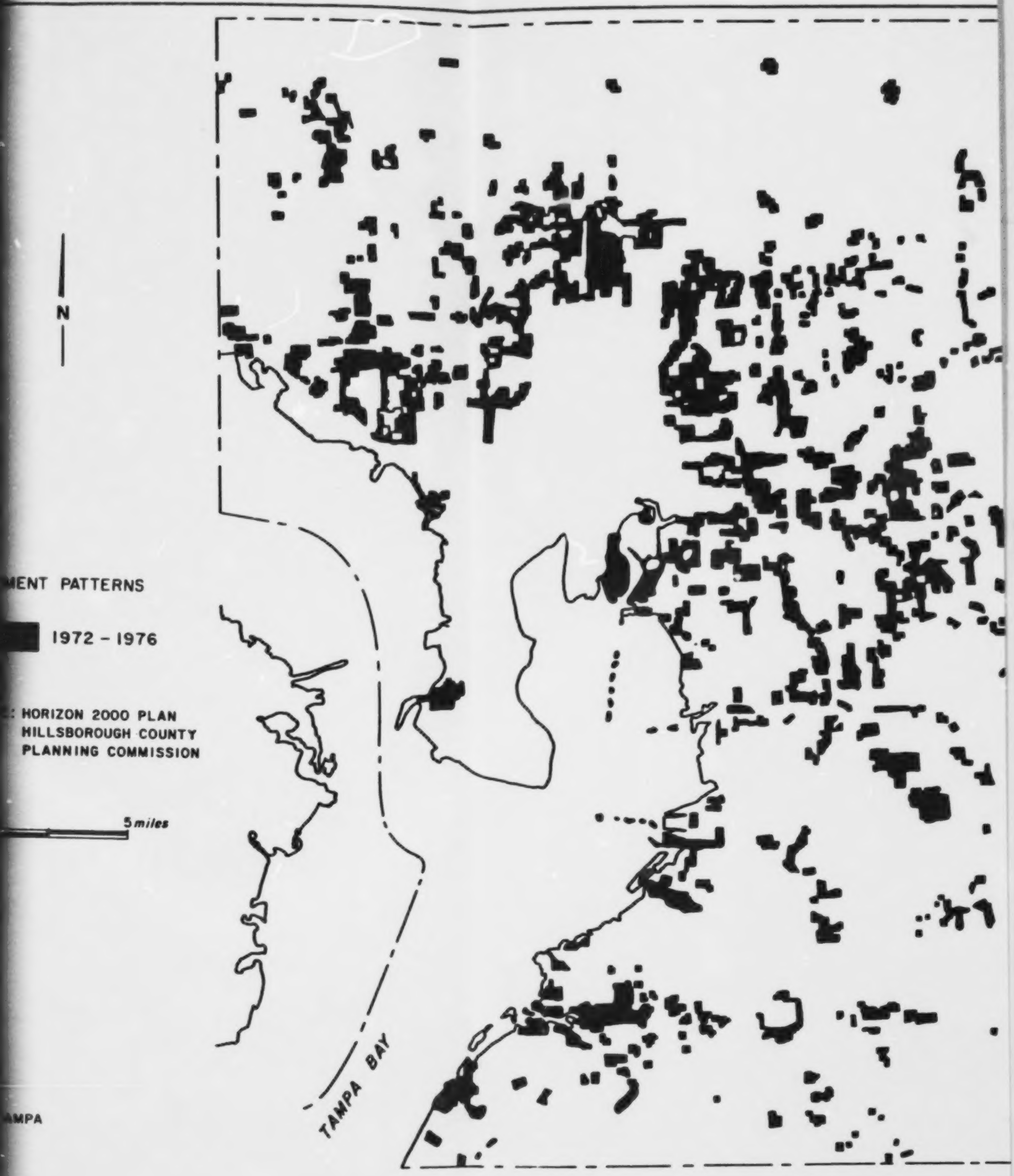
5 miles



DAMES & MOORE
FIGURE I.2-2


N
DEVELOPMENT PATTERNS
▇ 1972 - 1976
SOURCE: HORIZON 2000 PLAN
HILLSBOROUGH COUNTY
PLANNING COMMISSION
0
5 miles
TAMPA BAY

CENTRAL HILLSBOROUGH COUNTY - TAMPA
201 FACILITY PLAN
ENVIRONMENTAL REPORT
EPA No. C120634010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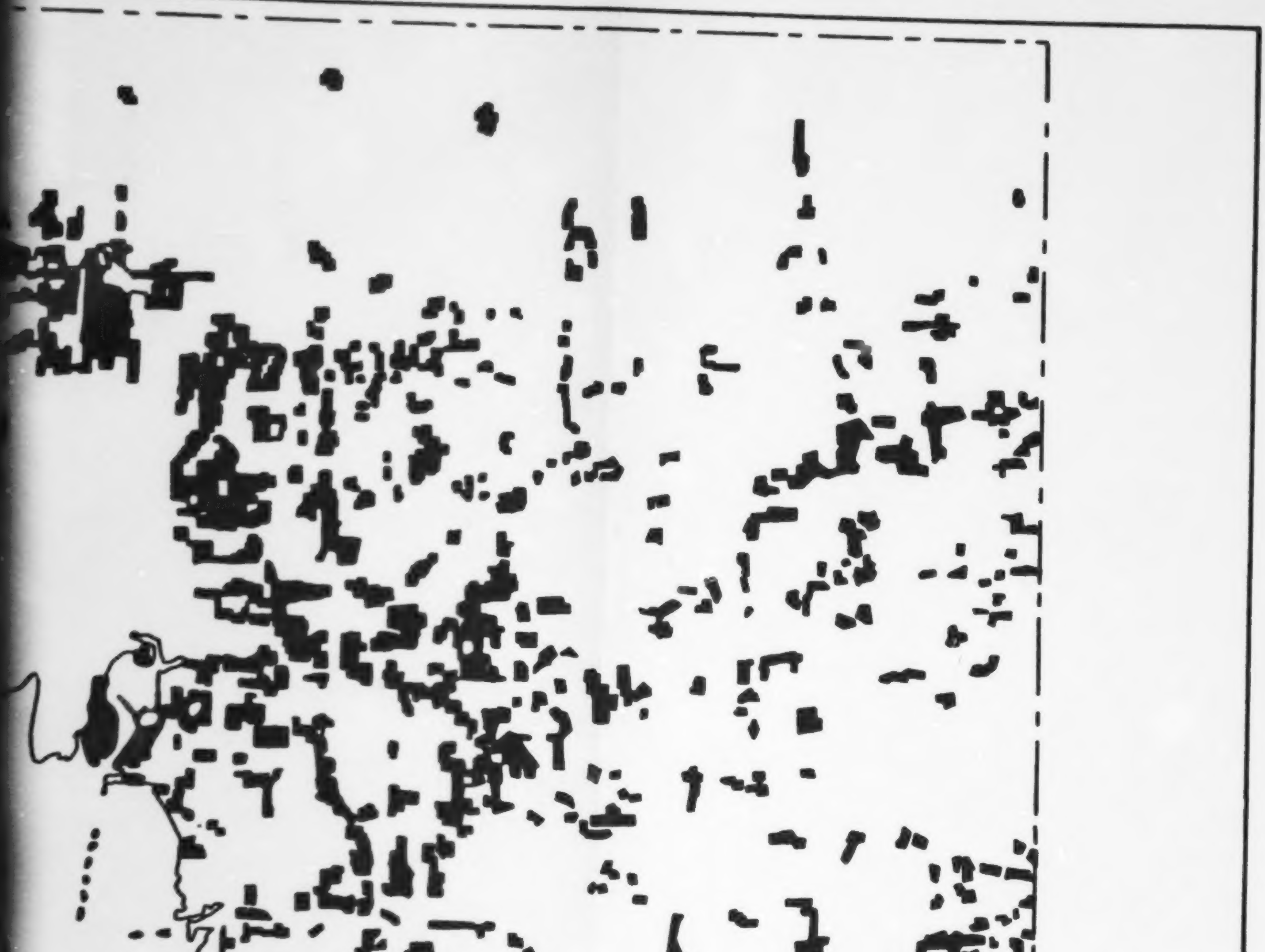
MENT PATTERNS
■ 1972 - 1976
: HORIZON 2000 PLAN
HILLSBOROUGH COUNTY
PLANNING COMMISSION
5 miles
TAMPA BAY
AMPA



I-25

DAMES & MOORE
FIGURE I.2-3

past development, more areas were developed, and in general, these were further from the existing urban area of the city.

The dispersed city phenomena is an urban-rural continuum. Areas of predominantly non-farm occupance, which include areas of commuter's residences, extend far beyond the city itself. The outer edge of the city is a wide zone of transition from areas that are solidly urban to more widely separated homes and subdivisions. Since more land is available for subdivisions than demanded, their specific location is random, based on complicated factors inherent in a speculative free land market. Premature development and late development are common. At any time before complete urbanization has occurred much of the land within the transition area is in speculative landholdings and unused.

The negative factors associated with this type of uncontrolled dispersed development are environmental degradation and spiraling service costs. Areas are bypassed or developed in a seemingly random manner and are thus difficult to accommodate and are too far from existing service areas.

Land use in Hillsborough County in 1976 was approximately 20 percent urban (133,465 acres) and 80 percent (539,993 acres) sparsely developed wetlands, forest or agricultural land. In comparison, the Planning Area, which includes the City of Tampa, is composed of approximately 419,840 acres, of which about 24 percent is in urban development. Table I.2-1 indicates the percentage of the three urban types (urban, urban transition, and suburban) within the Planning Area. Of the 99,240 acres of urban land in the Planning Area 60.7 percent are in intensive urban uses or heavy industry, 17 percent in moderate urban uses or in transition

TABLE I.2-1

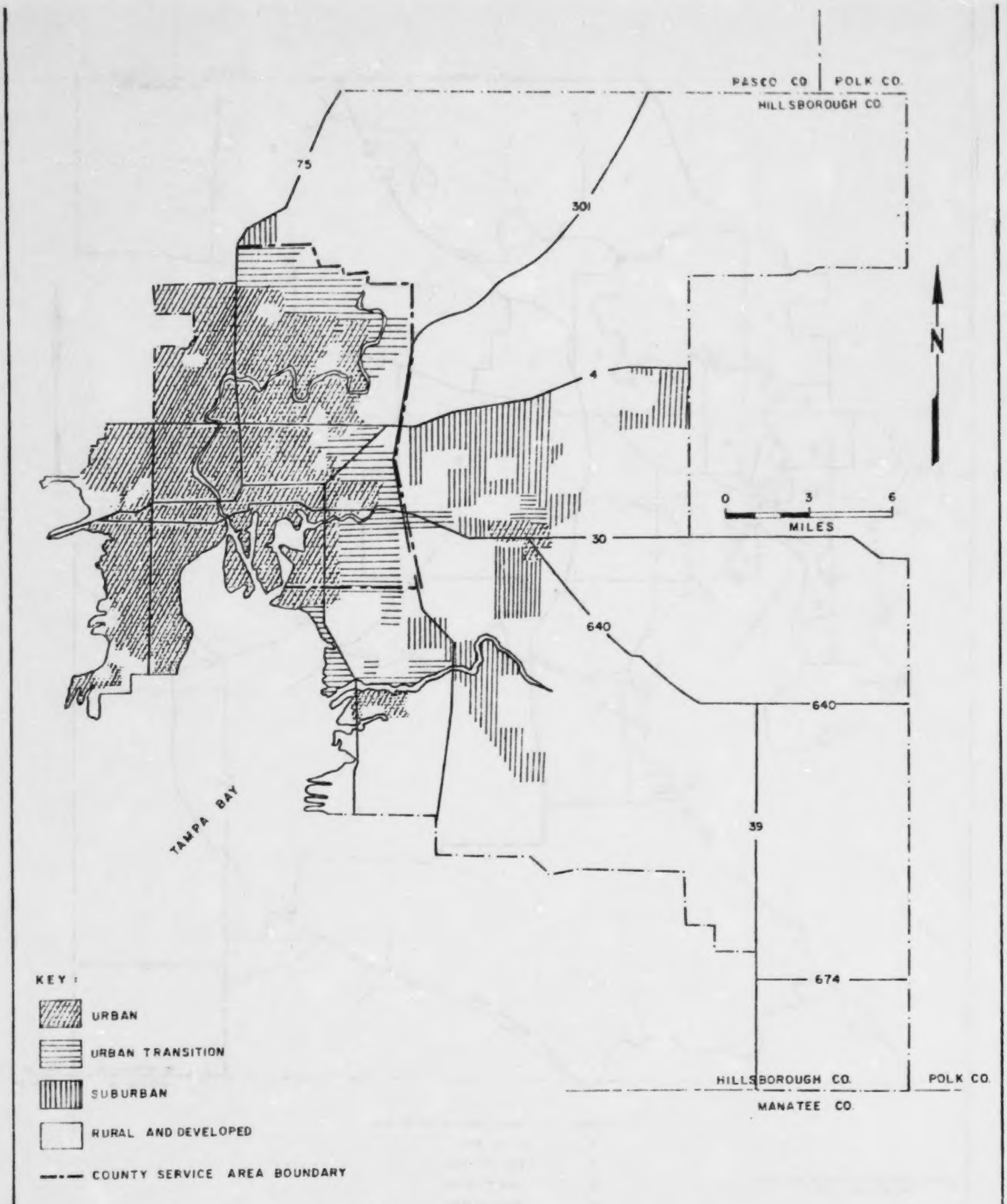
EXISTING AND PROJECTED LAND USE PERCENTAGES FOR 201 STUDY AREA

Type	1976	%	2000	%	Percent Change* 1976-2000
Urban and Industrial	60,253A	14%	79,066A	19%	+31%
Urban Transition Area	17,176A	4%	49,088A	12%	+185%
Suburban	21,811A	5%	63,520A	15%	+190%
Rural or Preservation	320,600A	76%	228,166A	54%	-29%

Note: Study area acreages calculated from Figures 3.2-4 and 3.2-7.

*May not total due to rounding.

Source: Greeley & Hansen and Smith & Gillespie, 1979C.


PASCO CO.
POLK CO.
HILLSBOROUGH CO.
75
301
4
30
640
640
39
674
N
0
3
6
MILES
TAMPA BAY
HILLSBOROUGH CO.
POLK CO.
MANATEE CO.
KEY:
▨ URBAN
▤ URBAN TRANSITION
▥ SUBURBAN
☐ RURAL AND DEVELOPED
-·- COUNTY SERVICE AREA BOUNDARY

SOURCE: GREELEY AND HANSEN, AND SMITH AND GILLESPIE, 1979

GENERALIZED LAND USE - YEAR 1976

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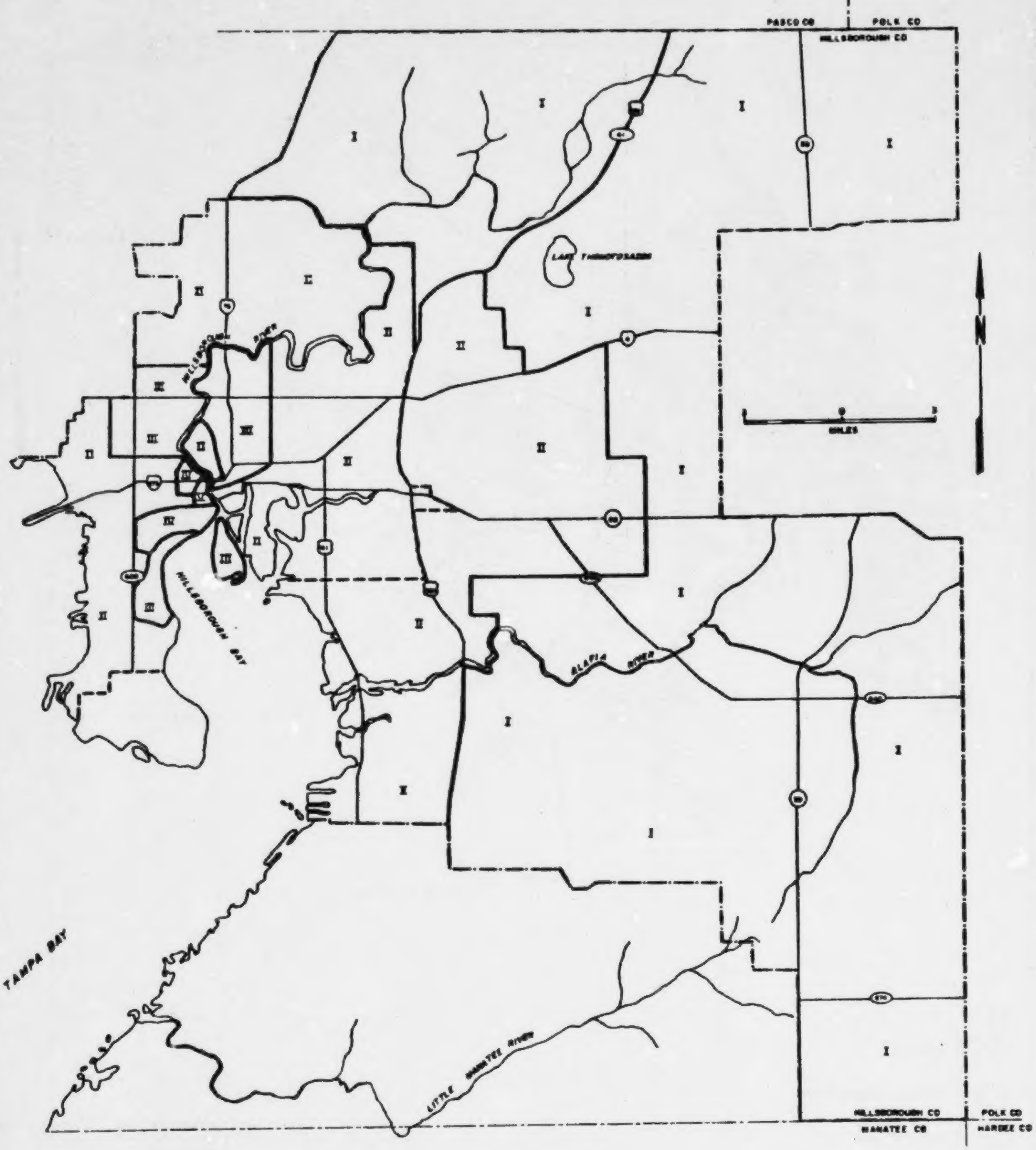
FIGURE I.2-4


PASCO CO
POLK CO
HILLSBOROUGH CO
LAKE THONOTOSASSA
N
0 3
MILES
HILLSBOROUGH RIVER
HILLSBOROUGH BAY
TAMPA BAY
ALAFIA RIVER
LITTLE MANATEE RIVER
HILLSBOROUGH CO
MANATEE CO
POLK CO
HARDEE CO
I
II
III
IV

CATEGORY	DENSITY (PERSONS PER SQ MILE
I	0 TO 900
II	900 TO 5,000
III	5,000 TO 10,000
IV	10,000 TO 15,000
V	15,000 TO 20,000
VI	20,000 TO 25,000
VII	25,000 TO 30,000
VIII	OVER 30,000

SOURCE: GREELEY AND HANSEN, AND SMITH AND GILLESPIE, 1979

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YEAR 1978 POPULATION DENSITY

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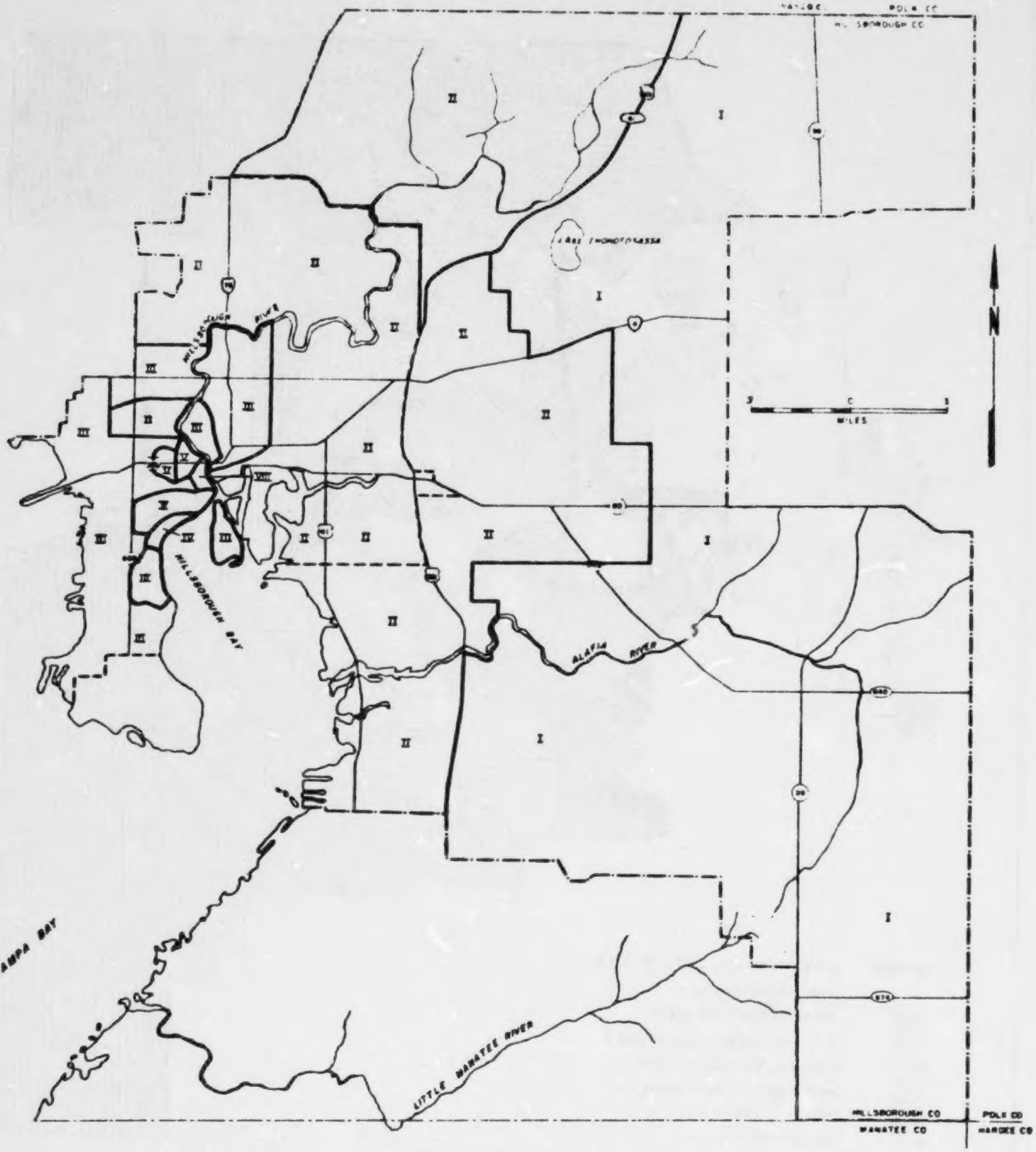
FIGURE I. 2-5


PASCO CO
POLK CO
HILLSBOROUGH CO
LAKE THONOTOSASSA
HILLSBOROUGH RIVER
HILLSBOROUGH BAY
ALAFIA RIVER
TAMPA BAY
LITTLE MANATEE RIVER
MILES
N
HILLSBOROUGH CO
MANATEE CO
POLK CO
HARDEE CO
I
II
III
IV
V
VIII

CATEGORY	DENSITY (PERSONS PER SQ MILE)
I	0 TO 500
II	500 TO 5,000
III	5,000 TO 10,000
IV	10,000 TO 15,000
V	15,000 TO 20,000
VI	20,000 TO 25,000
VII	25,000 TO 30,000
VIII	OVER 30,000

SOURCE: GREELEY AND HANSEN AND SMITH AND GILLESPIE, 1979

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YEAR 2,000 POPULATION DENSITY

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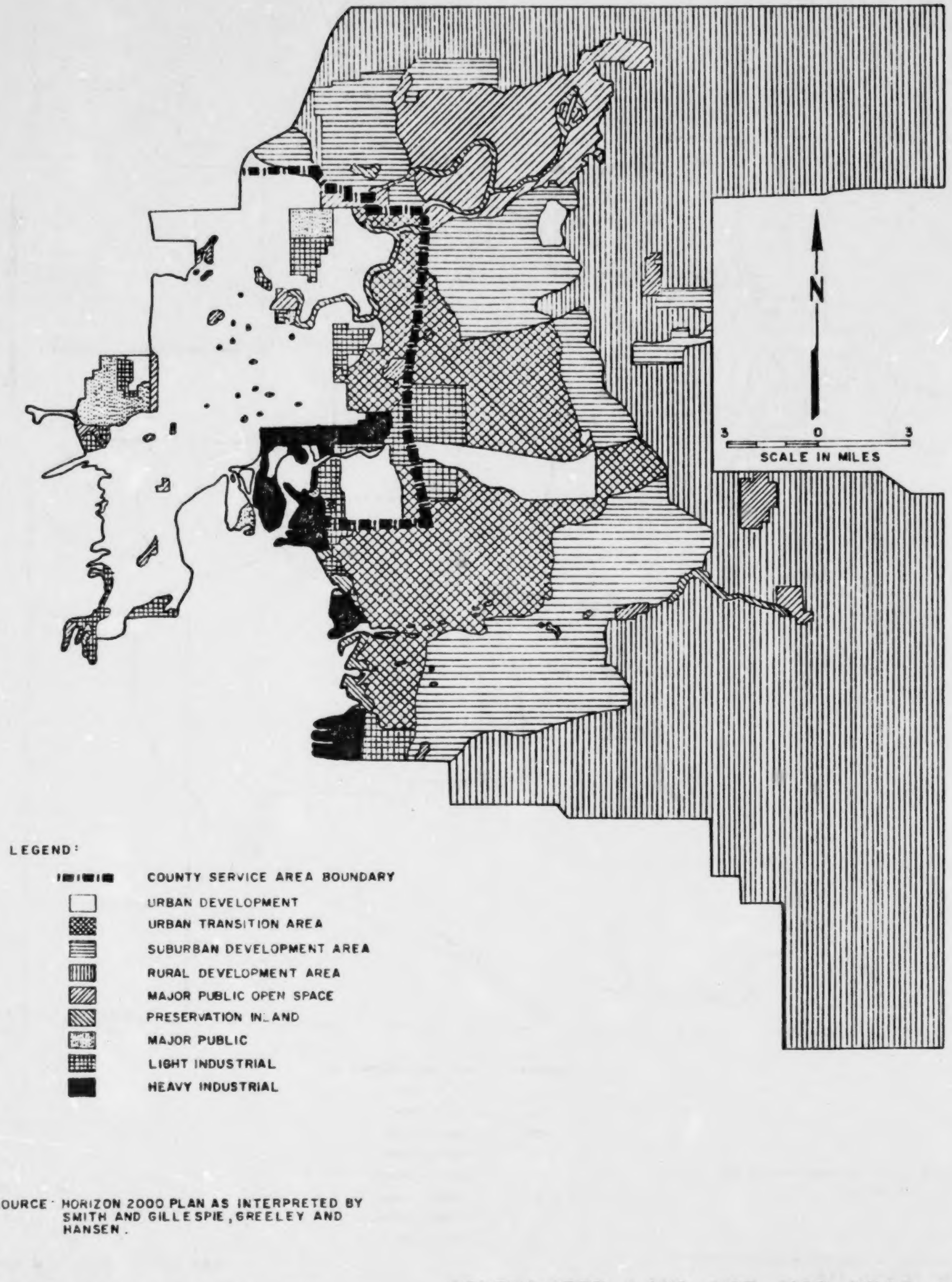
FIGURE I.2-6


N
3
0
3
SCALE IN MILES
LEGEND:
COUNTY SERVICE AREA BOUNDARY
URBAN DEVELOPMENT
URBAN TRANSITION AREA
SUBURBAN DEVELOPMENT AREA
RURAL DEVELOPMENT AREA
MAJOR PUBLIC OPEN SPACE
PRESERVATION INLAND
MAJOR PUBLIC
LIGHT INDUSTRIAL
HEAVY INDUSTRIAL

SOURCE: HORIZON 2000 PLAN AS INTERPRETED BY SMITH AND GILLESPIE, GREELEY AND HANSEN.

GENERALIZED LAND USE MAP - YEAR 2000

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FIGURE I. 2-7

to intensive urban usage, and 21.9 percent in suburban type development. Thus, the most common land use in the urban area is intensive and highly developed in nature. Figure I.2-4 illustrates the location of these urban land types within the Planning Area.

Predicted land use in the Planning Area for the year 2,000 is shown in Table I.2-1. By the year 2,000 urban land is predicted to compose more than 45 percent of the total Planning Area or approximately 191,674 acres. Most of this land classified as urban will be intensively developed. This intensively developed land will occupy almost 19 percent of the total Planning Area and account for over 40 percent of all urban land usage in the Planning Area.

Although intensively developed urban land is expected to increase by approximately 31 percent, land in transition to urban areas and suburban land are expected to increase by 185 percent and 190 percent, respectively. This indicates that urban transition land and suburban land is going to increase at a much greater rate than intensively used urban land.

The urban patterns are reflected in the population density pattern for the area (Figure I.2-5). In 1978, the highest population density was that in and around the Tampa's CBD. The density decreases as one moves away from the CBD with the lowest density found in east Hillsborough County in the area owned by the phosphate industry. The projected population density (Figure I.2-6) predicts a similar pattern for the future. The major change is that the higher density areas have expanded outward from the CBD.

I.2.2 Sensitive Areas

Sensitive environmental land uses which might be affected by sewer routing and subsequent development can be classified into two categories: 1) points of interest, or sensitivity, which occupy very little land area and 2) area uses, which occupy much larger land areas. For example, a sensitive point could be a historical building or an archeological site while a sensitive areal use might be a state park.

Categorizing sensitive uses as either point or areal types allows some general conclusions on the expected impacts of sewer routing to be advanced. Although sensitive areas should be avoided, pipeline construction is a one time event and after the line is in place little permanent impact or damage to the resources is expected. However, the urban development associated with the new sewer route may cause lasting impact.

Five maps have been developed depicting sensitive point and areal land uses for the following:

1. Historical and archeological sites (Figure I.7-1)
2. Parks and recreational areas (Figure I.7-2)
3. Flood plains and flood prone areas (Figure I.5-1)
4. Selected water resources (Figure I.13-3)
5. Soil potential for agricultural and urban development (Figure I.13-2)

A discussion of each of these maps and suggestions for its use during the sewer routing process is discussed in Section I.13, Sensitive Areas.

I.2.3 Land Use and Land Use Planning

Planning usually centers around a comprehensive plan (in the Planning Area it is the Horizon 2000 Plan) as a statement of local public policy. The Local Government Comprehensive Planning Act of 1975, under which the Horizon 2000 Plan was mandated, states that "no public or private development shall be permitted except in conformity with comprehensive plans..... adopted in conformity with this act" (Chapter 75-257, Florida Statutes, House Bill No. 782, Section 2, paragraph 4). The Horizon 2000 Plan has been adopted and provides a guide for local officials to the efficient development of Hillsborough County. Building permits cannot be issued to private persons where the proposed development does not correspond to the Horizon 2000 Plan. Land use regulations must be consistent with the comprehensive plan.

The elements of the plan which are significant to this 201 study are the existing (1976) land use and the desired land use for 2000. Examination of these two maps (Figures I.2-4 and I.2-7) indicates that the desired development pattern is one of increased density within the City of Tampa and its periphery. Further, locations of industrial concentrations and a range of desired residential density are outlined. In effect the Horizon 2000 Plan provides a basis for evaluating the 201 Plan's compatibility or incompatibility with land use goals.

I.2.4 Summary

It is highly likely that growth in the Planning Area will continue with or without the proposed action. Without the proposed action, growth would probably continue in the same pattern as has previously been experienced; that is, suburban sprawl. With the proposed action this trend towards suburban sprawl should be stopped or at the least, modified within portions of the Planning Area.

The impact of the proposed action upon land use will be to shape the pattern of growth. The placement of interceptors or feeder lines will economically enhance attractiveness of an area's potential for development.

The maps of sensitive areas identify those places where development is less desireable. Thus, they may be used to locate interceptors and disposal areas.

The sensitivity maps (Section I.13) and the Horizon 2000 Comprehensive Plan provide the basis for determining the development potential of the interceptor routes.

I.3. ATMOSPHERE

A considerable amount of information is available for Hillsborough County concerning climatological and air quality characteristics (and, to a much lesser extent, ambient noise characteristics). However, in keeping with the U.S. Council on Environmental Quality's regulations for preparation of federal environmental impact statements (40 CFR 1502), our intention is to avoid presenting a lengthy collection of baseline details which have little relevance to the project. Instead, our objective is to present a concise coverage of background information which can be used for better understanding of potential air quality impact and for better understanding of subjects (such as hydrology) which are directly affected by the climatology of the area.

I.3.1 Climate

This discussion of climate is divided into a section on general climatology and a more specific section on factors affecting dispersion of airborne pollutants. The discussion on general climatology is provided for perspective when evaluating the hydrological, ecological and design capacity aspects of the project. General climatology, especially wind flow patterns, also relates to air quality. The section on factors affecting dispersion is specifically applicable to the air quality aspects of the project.

TABLE I.3-1

NORMAL MONTHLY AND ANNUAL TEMPERATURE (^{o}F) AT TAMPA NATIONAL WEATHER SERVICE STATION, 1941-1970

Month	Normal	Average Daily Maximum	Average Daily Minimum
January	60.4	70.6	50.1
February	61.8	71.9	51.7
March	66.0	76.1	55.9
April	72.0	82.4	61.6
May	77.2	87.5	66.9
June	81.0	89.9	72.0
July	81.9	90.1	73.7
August	82.2	90.4	74.0
September	80.8	89.0	72.6
October	74.7	83.9	65.5
November	66.8	77.1	56.4
December	61.6	72.0	51.2
Annual	72.2	81.7	62.6

Source: USDC, 1974a

a. Climatology - General: Temperature and Humidity - Table I.3-1 presents a summary of temperature measurements from the National Weather Service (NWS) station at Tampa International Airport (USDC, 1974a). This summary is considered generally representative of the Planning Area. During the period 1964 through 1974, there were an average of 80 days per year with a maximum temperature of 90°F, or above, and an average of 4 days with a minimum temperature of 32°F or below (USDC, 1974a). Obviously, sub-freezing temperatures are very rare, a typical feature of sub-tropical, marine climates. The coastal influence also shows up in high average relative humidities as shown in Table I.3-2 for the period 1964-1974.

TABLE I.3-2

HUMIDITY, NATIONAL WEATHER SERVICE STATION AT TAMPA, 1964-1974

Time of Day	Maximum Mean Monthly Relative Humidity	Minimum Mean Monthly Relative Humidity
1 a.m., EST	85% (Aug)	80% (May)
7 a.m., EST	90% (Aug)	84% (Feb, Apr)
1 p.m., EST	65% (Aug)	50% (May)
7 p.m., EST	75% (Aug)	60% (May)

Source: USDC, 1974a

Precipitation and Fog - The normal rainfall pattern of the region consists of a wet summer season and a dry winter season. However, actual rainfall amounts on an annual, seasonal and monthly basis vary considerably from year to year. A summary of both normal rainfall and

TABLE I.3-3

NORMAL AND EXTREME MONTHLY AND ANNUAL RAINFALL (INCHES) AT TAMPA NATIONAL WEATHER SERVICE STATION

Month	Normal	Maximum	Minimum
January	2.33	8.02	Trace
February	2.86	10.92	0.21
March	3.89	12.64	0.06
April	2.10	6.59	Trace
May	2.41	7.55	0.16
June	6.49	18.52	1.86
July	8.43	20.59	2.31
August	8.00	18.59	0.78
September	6.35	13.04	1.05
October	2.54	7.36	0.02
November	1.79	6.12	Trace
December	2.19	7.04	0.09
Annual	49.38	76.57	28.89

Period of Record: Normal, 1941-1970
Extremes, 1935-1974

Source: USDC, 1974a

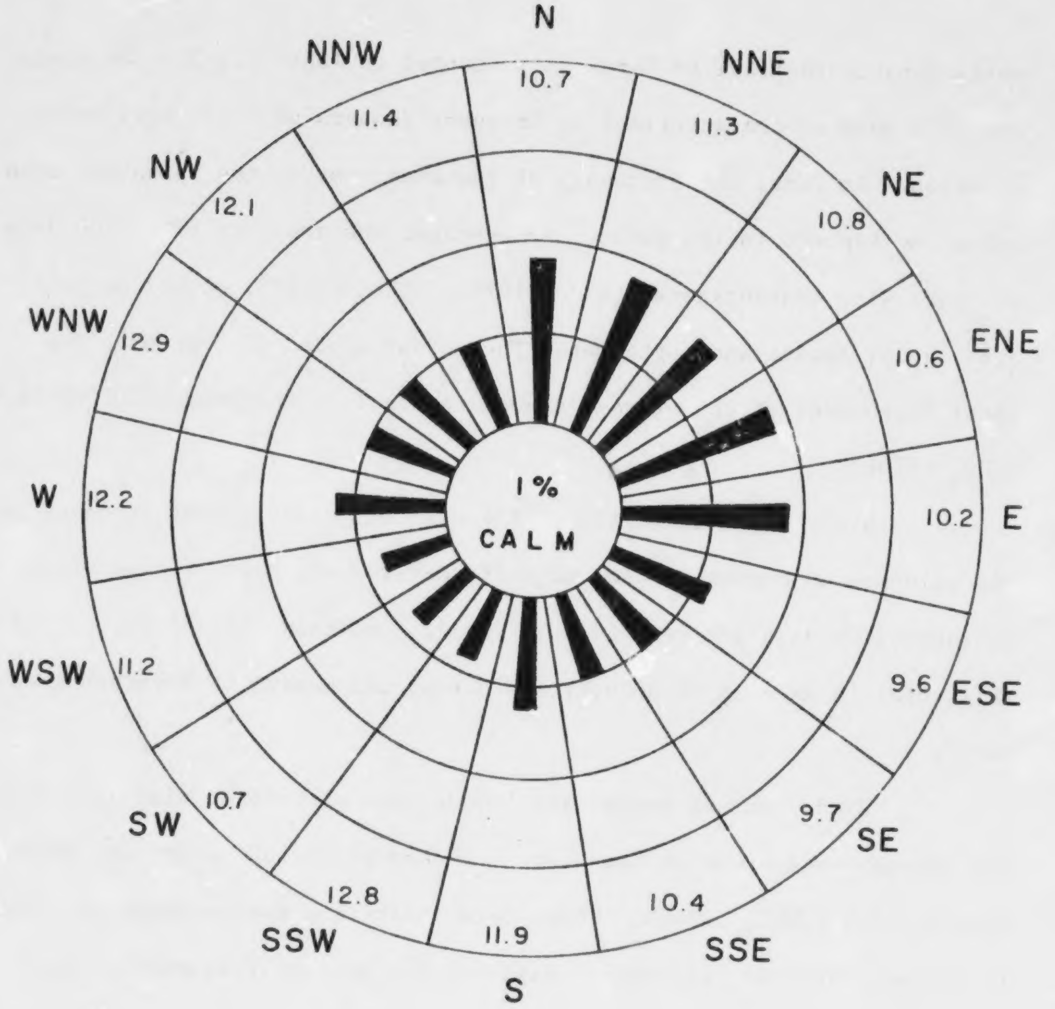
variations in rainfall at Tampa is presented in Table I.3-3. The summer rainfall peak is characterized by frequent showers of relatively brief duration. In fact, the frequency of thunderstorms in the Tampa Bay area is among the highest in the world. An average, the area has 87 to 100 days per year with thunderstorms (USDC, 1974a; USDC, 1974b), occurring mostly in June, July, August and September. These four months also account for about 60 percent of the average annual rainfall in the region (USDC, 1974a; USDC, 1974b).

Heavy fog (visibility of 1/4 mile or less) is most frequent in the cold-season months. Based on a 28 year record, heavy fog occurs on an average of 24 days per year (USDC, 1974a). Approximately 83 percent of this total is made up of occurrences during the months of November through March.

Wind - Annual percentage frequencies of surface wind direction and average wind speed at Tampa for a 5 year period of record are shown in Figure I.3-1 (USDC, 1974c). These data indicate a predominance of northerly through easterly (clockwise) winds with a maximum frequency of winds from easterly directions. As indicated in Figure I.3-1, a westerly sea breeze is also a recurring daytime feature. This feature is most prominent during the late spring and summer months.

The annual average wind speed for all directions combined based on the 5 year data base summarized in Figure I.3-1 is 10.9 mph. Longer term records (USDC, 1974a) indicate that this average may be a little higher than is typical. Also, wind speeds farther inland may be lower than those measured at the Tampa NWS station.

Severe Weather - Severe weather is generally associated with tropical cyclones (hurricanes), although tornadoes and severe thunderstorms



NOTE:

CONCENTRIC CIRCLES REPRESENT 5% FREQUENCY INTERVALS. AVERAGE WIND SPEED (mph) SHOWN ALONG OUTER CIRCUMFERENCE FOR EACH DIRECTION. PERIOD OF RECORD : 1960-1964

SOURCE:

U.S.D.C., 1974e

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ANNUAL WIND ROSE FOR TAMPA

DAMES & MOORE

FIGURE I.3-1

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not associated with tropical cyclones have caused property damage in the area. The Gulf hurricane of October 25, 1921, brought Tampa Bay's most destructive and highest tide, 10.5 feet above mean low water (USDC, 1974a). The highest wind velocity measured at Tampa, 75 mph for a 5 minute period, occurred during the passage of the Labor Day hurricane of September 3-5, 1935 (USDC, 1974a). Eight tropical cyclones have reached a 50 nautical mile segment of the Florida coastline centered due west of Tampa during the period 1886-1970 (Simpson and Lawrence, 1971). Five of these were of hurricane stength, of which one was a great hurricane (defined as having winds of 125 mph or greater.

b. Climatology - Factors Affecting Dispersion: Atmospheric stability in conjunction with the general ventilation (winds) indicates the ability of the atmosphere to disperse airborne pollutants. The degree of atmoshperic stability determines the amount of vertical and lateral mixing or dispersion of air pollutants as they are carried away from their source.

Meteorological conditions which lead to high air pollution potential are light winds accompanied by surface inversions and above-surface stable layers (limited mixing). Surface inversions are typically short-term, early morning phenomena; daytime heating usually eliminates inversions and creates a uniform mixing layer by mid-afternoon. Mixing height is defined as the thickness of the surface layer in which relatively vigorous vertical mixing takes place.

One of the most commonly used methods of assessing the stability of the atmosphere is based on a technique developed by Turner (1964), often referred to as the STAR method. Discrete stability classes are determined objectively using values of wind speed, cloud cover and solar angle. The advantage of this method is that suitability can be assessed for any of the major weather stations throughout the country where wind and cloud cover observations are recorded.

The usual procedure is applying the STAR method is to separate stability conditions into 5, 6 or 7 distinct classes. Table I.3-4 presents the mean annual frequency distributions of stability classes at Tampa. The seven stability classes have been combined into three general categories; unstable, neutral and stable, in order to simplify presentation.

TABLE I.3-4

ANNUAL STABILITY CLASS PERCENT FREQUENCY DISTRIBUTION

Stability Class	Definition	Tampa (1960-1964)
A, B, C	Unstable	17
D	Neutral	51
E, F, G	Stable	32

Source: USDC, 1974c

Since Tampa is considered to be representative of general dispersion conditions in the Planning Area, the above STAR data would appear to indicate that dispersion conditions in the Planning Area are generally good due to a combination of moderate wind speeds and the existence of unstable and neutral conditions almost 70 percent of the time. However,frequent periods of limited dispersion can be expected to occur since stable conditions are present approximately 30 percent of the time.

Episodes of stagnation or limited dilution have been analyzed by Holzworth (1974). Episodes of limited dilution are defined as periods of a given duration in which specified values of mixing height and average wind speed within the mixing layer were not exceeded and significant precipitation did not occur. Episodes as thus defined represent periods when there is a potential for high pollutant concentrations, not necessarily periods when high concentrations were actually observed.

Holzworth's stagnation analysis is based on an examination of balloon sounding data from 62 observing stations throughout the U.S. covering generally a five year period. Using the product of mixing height times wind speed, which is sometimes referred to as a ventilation factor, the 62 stations examined were ranked in order of increasing dilution for episodes lasting 1, 2, 3, 4 and 5 days. In other words, the higher the ranking, the greater is the dispersion capacity of the atmosphere during periods of slowest dilution.

Rankings for Tampa (with two other Florida locations shown for comparison) are listed in Table I.3-5. What these numbers indicate is that the severity of stagnation episodes at Tampa is not as great as at some other locations in Florida.

In summary, dispersion conditions in the Planning Area are expected to be generally good due to a combination of favorable atmospheric ventilation and stability conditions. Even when stagnation episodes do occur, they are expected to be less severe than at many other locations in the U.S.

I.3.2 Baseline Ambient Air Quality

a. Ambient Air Quality Standards: To aid in interpretation of ambient air quality measurements, state and federal ambient air quality standards are presented in Table I.3-6. Three points need to be understood for proper interpretation of these standards:

TABLE I.3-5

RANK ORDER OF FLORIDA STATIONS DURING EPISODES OF SLOWEST DILUTION IN COMPARISON WITH 59 OTHER U.S. LOCATIONS[a]

Station	Duration of Episode				
	1-Day	2-Day	3-Day	4-Day	5-Day
Jacksonville	54	62	59	55	51
Miami	62	60	56	57	56
Tampa	56	61	55	58	45

[a] Higher rankings represent better dilution rates. Highest possible ranking is 62 (i.e., best of the 62 stations); lowest is 1.

Source: Holzworth, 1974

TABLE I.3-6

FEDERAL AND STATE AMBIENT AIR QUALITY STANDARDS
(Concentrations in g/m^3 ppm)

Pollutant and Averaging Period	Federal Primary	Federal Secondary	State
Sulfur Dioxide			
3-Hour Average	--	1300[a] (0.5)	1300[a] (0.5)
24-Hour Average	365[a] (0.14)	--	260[a] (0.10)
Annual Arithmetic Mean	80 (0.03)	--	60 (0.02)
Particulate Matter			
24-Hour Average	260[a]	150[a]	150[a]
Annual Geometric Mean	75	60[b]	60
Nitrogen Dioxide			
Annual Arithmetic Mean	100 (0.05)	100 (0.05)	100 (0.05)
Carbon Monoxide			
1-Hour Average	40,000[a] (35)	40,000[a] (35)	40,000[a] (35)
8-Hour Average	10,000[a] (9)	10,000[a] (9)	10,000[a] (9)
Photochemical Oxidants (State)/Ozone (Federal)			
1-Hour Average	235[c] (0.12)	235[c] (0.12)	160[a] (0.08)
Hydrocarbons			
3-Hour Average	160[d]	160[d]	160[d]
Lead			
Quarterly Arithmetic Mean	1.5	1.5	e

---

[a] Not to be exceeded more than once per year.
[b] As a guide to be used in assessing implementation plan to achieve the 24-Hour secondary standard.
[c] Attained when the expected number of days per calendar year with maximum hourly average concentrations above the standard is equal to or less than one.
[d] Maximum 3-Hour concentration for the period 6 to 9 a.m., to be used as a guide in devising implementation plans to achieve oxidant (ozone) standards.
[e] Standard not yet adopted by state.

Source: Florida Administrative Code, 1979

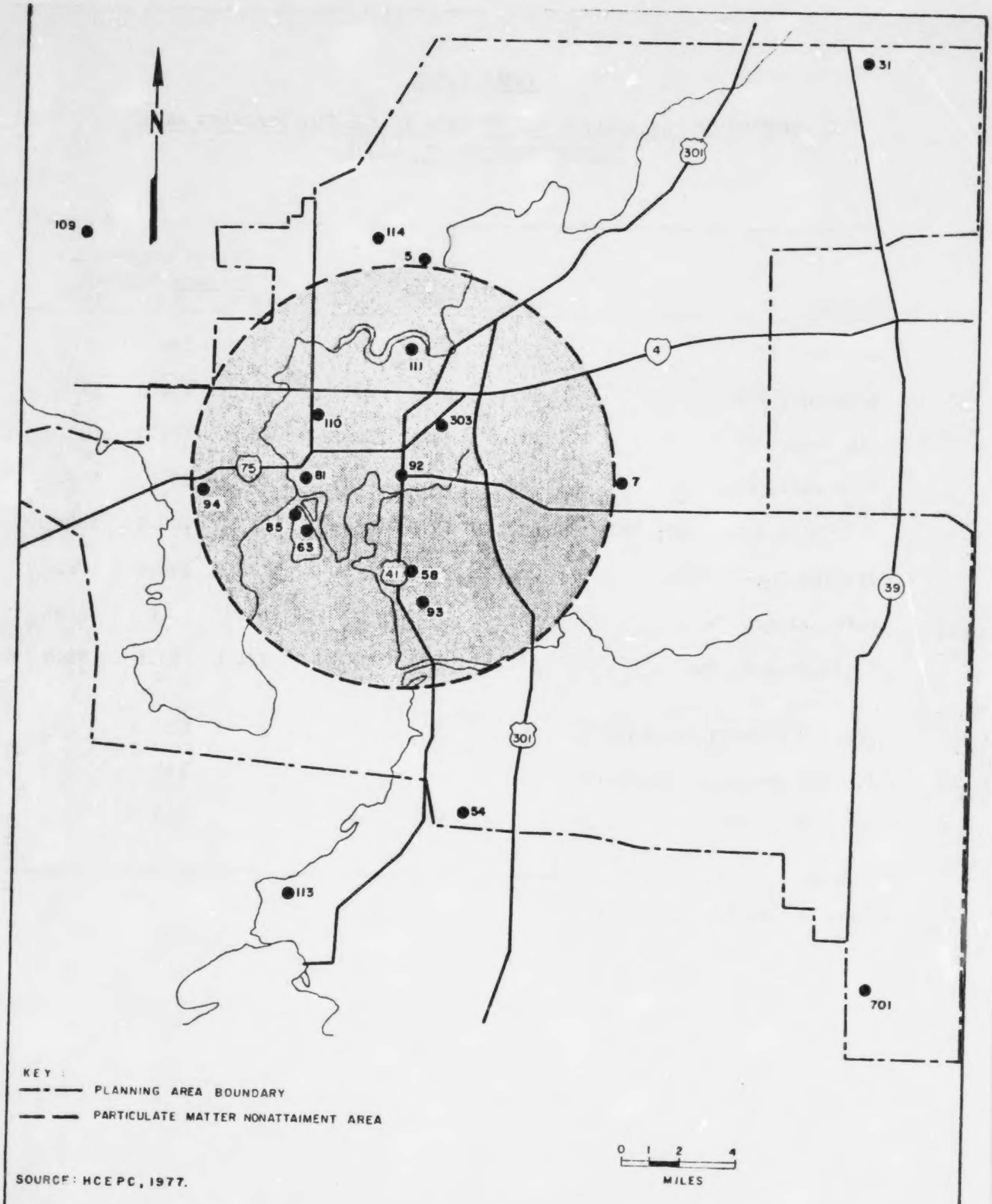
1. The federal list is divided into primary and secondary standards. Primary standards were developed to protect human health, whereas secondary standards were developed to protect "human welfare" from adverse effects. Adverse welfare effects include such things as, vegetation damage, extreme degradation of visibility and damage to materials.

2. The state and federal limit on hydrocarbon concentrations is meant as a guide only and is not enforced as a standard. Similarly, the federal secondary annual average particulate matter standard is a guide only.

3. The federal ozone standard has very recently (2/8/79) been revised to the level shown in Table I.3-6. The Florida Department of Environmental Regulation plans to consider changing the state standard so that it will be identical with the federal standard, but it is not yet known if or when a change will be made. Ozone nonattainment designations are based on the federal standard.

b. Baseline Ambient Air Quality: This section presents and discusses ambient air quality measurements and trends in the Planning Area over the last three years (1976-1978). Particular attention is focused on a comparison of measurement data with the appropriate standards given in Section I.3.2.a. How these data relate to the latest official attainment/nonattainment designation for the Planning Area is also discussed.

The Hillsborough County Environmental Protection Commission (HCEPC) routinely monitors air quality in Hillsborough County. The HCEPC also compiles data from monitors operated by private organizations such as electric utilities and various industries. Figure I.3-2 shows the locations of non-continuous and continuous monitors from which the measurements summarized in this section were obtained. Data for the period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PLANNING AREA BOUNDARY
PARTICULATE MATTER NONATTAIMENT AREA
0 1 2 4
MILES

SOURCE: HCEPC, 1977.

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201 FACILITY PLAN
ENVIRONMENTAL REPORT
EPA No. C120634010

LOCATION OF AMBIENT AIR QUALITY MONITORING STATIONS

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FIGURE I.3-2

TABLE I.3-7

SUMMARY OF PARTICULATE MATTER DATA IN THE 201 PLANNING AREA
(Concentrations in g/m^3)

	Annual Geometric Mean			Second Highest 24-Hour Average		
Station	1976	1977	1978	1976	1977	1978
Brandon, #7	39.8	42.4	39.9	73.0	104.0	71.0
Brewster, #701	38.9	57.3	49.7	73.0	130.0	95.0
Big Bend, #54	38.6	37.6	43.7	64.0	103.0	100.0
ICWU Hall, #93	39.5	33.3	53.8	73.0	83.0	131.0
Hwy. 41 and Hwy. 60, #92	69.2	67.3	77.45	111.0	109.0	124.0
Florida Steel, #303	100.25	89.7	58.4	176.0	204.0	106.0
Water Plant, #5	36.9	29.5	37.25	64.0	57.0	66.0
Davis Island, #63	57.2	61.7	67.8	124.0	171.0	168.0
Federal Primary Standard		75			260	
Federal Secondary Standard		--			150	
State Standard		60			150	

Source: HCEPC, 1976-1978

TABLE I.3-8

SUMMARY OF SULFUR DIOXIDE DATA IN THE 201 PLANNING AREA
(Concentrations in ppm)

Station	Annual Geometric Mean			Second Highest 24-Hour Average			Second Highest 3-Hour Average		
	1976	1977	1978	1976	1977	1978	1976	1977	1978
Brandon, #7	.001[a]	.001	.001	.003[b]	.003	.001	___[b]	--	--
Central Phosphates, #31	.004[c]	.004	.002	.027[c]	.035	.016	--	--	--
Big Bend, #54	.004[a]	.004	.003 [d]	.020[a]	.033	.018	--	.058 [e]	.093
Davis Island, #63	.0145	.011	.009	.047	.039	.028	.160	.173	.114
ICWU Hall, #93	.004[a]	.004	.004	.015[a]	.016	.039	--	--	--
USF, #114	f	.004	f	f	.015 [g]	f	f	h	f
Brewster, #701	.001[c]	.001[e]	.001	.001[c]	.001[e]	.001	--	--	--
Federal Primary Standard		0.03			0.14			--	
Federal Secondary Standard		--			--			0.5	
State Standard		0.02			0.10			0.5	

Source: HCEPC, 1976-1978

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[a] Sampling bubbler refrigerated for part of year only.
[b] Dash indicates 3-Hour average not available from non-continuous monitor.
[c] Not known whether sampling bubbler refrigerated.
[d] Brackets indicate continuous monitor.
[e] Might not be representative of annual conditions (insufficient data).
[f] No monitoring.
[g] Highest value, second highest not available.
[h] Not available.

TABLE I.3-9

SUMMARY OF OZONE DATA IN THE 201 PLANNING AREA
(Concentrations in ppm)

Station	Highest and Second Highest 1-Hour Averages					
	1976		1977		1978	
Davis Island, #63	.130,	.125	140,	.135	.125,	.120
Citrus Park, #109	.110,	.110	.110,[a]	.108[a]	.102,[a]	.100[a]
7402 N. 56th St., #111	.055[a,b]		.145,[a]	.130[a]	.120,[a]	.115[a]
E.C. Simmons Park, #113	--[c]		--		.138,[a]	.128[a]
Federal Primary and Secondary Standard			0.12			
State Standard			0.08			

---

[a] Might not be representative of annual condition (insufficient data).
[b] Highest value, second highest not available.
[c] Dash indicates no monitoring.

Source: HCEPC, 1976-1978

TABLE I.3-10

SUMMARY OF NITROGEN DIOXIDE DATA IN THE 201 PLANNING AREA
(Concentrations in ppm)

Station	1976	1977	1978
Brandon, #7	.013	.012	.013
Big Bend, #54	.007	.012	.022[a]
TECO Substation, #58	.009	.014	.027
TECO-Davis Island, #85	.006	.018	.032
Cypress and Dale Mabry, #94	.031	.036	.035[a]
Federal Primary and Secondary Standard		0.05	
State Standard		0.05	

[a] Might not be representative of annual conditions (insufficient data).

Source: HCEPC, 1976-1978

TABLE I.3-11

SUMMARY OF CARBON MONOXIDE DATA IN THE 201 PLANNING AREA
(Concentrations in ppm)

Station	Second Highest 1-Hour Average 1976	1977	1978	Second Highest 8-Hour Average 1976	1977	1978
906 Jackson, #81	8.3[a]	7.0[a]	--[b]	3.0[a]	4.6[a]	--
Cypress and Dale Mabry, #94	17.5	--	--	8.4	--	--
Buffalo and Dale Mabry, #100	17.3[a]	--	17.5[a,c]	9.4[a]	--	a
Federal Primary and Secondary Standard		35			9	
State Standard		35			9	

[a] Might not be representative of annual conditions (insufficient data).
[b] Dash indicates no monitoring.
[c] Highest value; second highest not available.
[d] Not available.

Source: HCEPC, 1976-1978

1976-1978 (HCEPC, 1976; HCEPC, 1977; HCEPC, 1978) are summarized in Tables I.3-7 through I.3-11.

Particulate Matter - Suspended particulate matter in Hillsborough County was sampled according to a random sampling schedule which resulted in samples being taken every sixth day on the average. Data in Table I.3-7 indicate that particulate levels in that part of the Planning Area outside of the Tampa urban area were generally well below federal and state ambient air quality standards. This part of the Planning Area is currently designated by EPA (1978a) as attaining the National Ambient Air Quality Standards (NAAQS) for particulate matter. However, EPA has designated the urban area of Tampa contained within the circle illustrated in Figure I.3-2 as not attaining the secondary NAAQS for particulate matter. This designation was based in part on the measurements summarized in Table I.3-7.

The apparent trend in particulate matter concentrations during the period 1976-1978 in the Tampa urban area was toward higher particulate matter levels. No definite trend is evident in the rest of the Planning Area.

Sulfur Dioxide (SO_2) - Continuous and non-continuous monitoring of sulfur dioxide was conducted in Hillsborough County during the period 1976-1978. Non-continuous sampling consisted of 24-hour bubbler measurements obtained every sixth day (most of these measurements were temperature controlled). Data in Table I.3-8 indicate that SO_2 levels in the Planning Area during the period 1976-1978 were generally well below federal and state ambient air quality standards. Of the stations chosen to represent the Planning Area, the Davis Island station registered highest SO_2 levels, but these were still appreciably below the federal and state standards. Nevertheless, EPA (1978a) has designated Hillsborough County as "unclassifiable" with respect to attainment of SO_2 standards.

Although a trend in ambient SO_2 concentrations is not clearly discernible, it appears that SO_2 levels in the Planning Area might have decreased slightly during the period 1976-1978.

Ozone (O_3) - Limited continuous ozone monitoring was conducted in Hillsborough County during the period 1976-1978. Most of the data obtained are summarized in Table I.3-9. Even though the federal standard was revised upward in February 1979, all of Hillsborough County is still designated nonattainment for ozone by EPA. This is supported by the data in Table I.3-9 which indicates that ozone levels exceed the federal standard for the entire period 1976-1978. The state standard is also violated. According to HCEPC (1979a), maximum concentrations for each year at each station occur on different days so that the expected number of days with concentrations exceeding the standard is greater than one and thus the standard is not met. Although a clear trend in O_3 concentrations is not readily apparent, it appears that ambient levels in the Planning Area might have decreased very slightly during the period 1976-1978.

Nitrogen Dioxide (NO_2) - NO_2 in Hillsborough County was sampled in Hillsborough County during the period 1976-1978. Data obtained are summarized in Table I.3-10. No violations of the federal and state one hour standard were recorded during the period. The 8 hour standard was violated at the Buffalo and Dale Mabry monitor in 1976. Hillsborough County is currently designated by EPA (1978b) as "cannot be classified or better than National Standards" for NO_2.

The apparent trend in NO_2 concentrations during the period 1976-1978 in the Tampa urban area was toward an increase in No_2 levels.

Not enough sampling data are available to comment about trends in the rest of the Planning Area.

Carbon Monoxide (CO) - Very limited continuous CO monitoring was conducted in Hillsborough County during the period 1976-1978. Data obtained are summarized in Table I.3-11. No violations of the federal and state one hour standard were recorded during the period. The 8 hour standard was violated at the Buffalo and Dale Mabry monitor in 1976. Hillsborough County is currently designated by EPA (1978b) as "cannot be classified or better than National Standards" for CO. Lack of data precludes reaching a conclusion about ambient concentration trends.

I.3.3 Emissions Inventory

Emissions inventory data provided by HCEPC (1977) is shown in Table I.3-12. The latest year for which comprehensive data are available for Hillsborough County is 1977. The following figures summarize estimated emissions for that year.

Particulate emissions amounted to approximately 35,000 tons, of which about 54 percent was estimated to be dust re-entrained by traffic on paved roads. This was the largest area source of particulate matter. The largest point source of particulate matter was the electric utilities category which contributed an estiamted 11.1 percent of the total. Tampa Electric Company's Big Bend plant was the largest single point source of particulate matter.

Sulfur dioxide emissions were estimated to be approximately 245,000 tons, of which about 91 percent was credited to Tampa Electric Company's three power generating facilities. The largest non-point source of SO_2 was composed of transportation related sources.

TABLE I.3-12

1977 EMISSIONS INVENTORY FOR HILLSBOROUGH COUNTY, FLORIDA
(Percent of Total Emissions)

Sources	Particulates	SO_2	NO_2	Hydro-carbons	CO
Electric utilities	11.1	90.8	73.6	--	--
Industry	8.3	4.6	--	--	4.8
Transportation	10.4	4.2	--	--	--
Other fuel combustion	1.0	0.4	2.0	--	--
Paved roads dust	53.9	--	--	--	--
Construction	1.3	--	--	--	--
Unpaved roads	6.9	--	--	--	--
Highway vehicles	--	--	17.7	--	--
Other transportation	--	--	6.7	--	--
Mobile Sources	--	--	--	59.4	95.2
Petroleum products handling	--	--	--	22.4	--
Other miscellaneous sources	7.0	--	--	18.2	--
Total (tons/year)	35,283	244,990	104,000	43,875	264,592
Percent of all Emissions	5.1	35.4	15.0	6.3	38.2

Source: HCEPC, 1977

Nitrogen dioxide emissions in 1977 amounted to an estimated 104,000 tons, of which about 74 percent was emitted by electric utilities. Transportation related sources contributed over 24 percent of the total.

Volatile organic compound (hydrocarbon) emissions from controlled sources totaled an estimated 44,000 tons, of which over 59 percent came from automobiles and other mobile sources. Petroleum handling and storage sources contributed almost 38 percent of the total. Natural sources of hydrocarbons (various types of vegetation), although not considered in the total shown above, are estimated to contribute a significant additional amount (HCEPC, 1977). Hydrocarbons along with oxides of nitrogen are considered to be important in the formation of ozone. Control of their emissions is assumed to result in a reduction in ozone levels.

Finally, carbon monoxide emissions were estimated to be approximately 265,000 tons, of which over 95 percent was attributed to automobiles and other mobile sources.

Reliable projected emission rates for all the criteria pollutants are not available for Hillsborough County. However, projected emissions of VOC (volatile organic compounds) were developed as part of a transportation emissions control plan for Hillsborough County (TUATS, 1979). This plan was included in the Florida State Implementation Plan (SIP) revision recently sumbitted to EPA. Based largely on replacement of older vehicles by new better controlled vehicles, there will be a projected 17 percent reduction in total VOC emissions from mobile sources by 1982 (compared to 1977), and a 37 percent reduction by 1987. A reduction of 30 percent in total VOC emissions from stationary sources by 1982 and 46 percent by 1987 is also projected. Total VOC emissions are expected to be reduced by 22 percent

TABLE I.3-13

SOUND LEVEL LIMITS

Receiving Land Use Category	Time of Day	Sound Level Limit, dBA
Residential, Public Space Agricultural, or Institutional	7 a.m. - 10 p.m. 10 p.m. - 7 a.m.	60 55
Commercial or Business	7 a.m. - 10 p.m. 10 p.m. - 7 a.m.	65 60
Manufacturing or Industrial	At all times	75

by 1982 and 40 percent by 1987. These reductions are expected to result in compliance with ambient ozone standards by 1982 within Hillsborough County.

I.3.4 Ambient Noise Conditions

a. Noise Regulations: The proposed project will include noise sources such as treatment facilities, pumping stations and construction equipment. Noise control regulations have been adopted for Hillsborough County, and it will be necessary for all noise source associated with the project to comply with these regulations. The regulations specify sound levels not to be exceeded within different land use areas, as shown in Table I.3-13:

b. Ambient Noise Measurement: The HCEPC conducted a residential noise survey in June 1978 at 15 randomly selected sites throughout Tampa. Results of this survey were combined with measurements at six sites within the noise pattern of Tampa International Airport (measurements taken during preparation of a Development of Regional Impact study) to arrive at an overall "City Noise Index" for the county. The average equivalent sound level, L_{eq}, for all 22 sites was 55 dBA. (The equivalent sound level is defined as the time-averaged, mean square, A-weighted sound pressure). This value was converted to a day/night sound level, L_{dn}, by adding 3 dBA to the L_{eq} values for all measurement sites was 39 dBA to 71 dBA, equivalent to an L_{dn} range of 42 dBA to 74 dBA.

Highest noise levels were measured at locations which could be significantly affected by air traffic in and out of Tampa International Airport. As discussed in the HCEPC report, the relatively high City Noise Index of 58 dBA is largely attributable to the influence of civilian and military jet aircraft. We conclude that a more appropriate L_{dn} average value for the Planning Area, especially for the less populated eastern half which is farther removed from Tampa International Airport and MacDill AFB, would be on the order of 50 to 55 dBA.

I.3.5 Odor

Although the HCEPC receives odor complaints from time to time, there are no pervasive odor problems throughout the county Planning Area (HCEPC, 1979b). Therefore, there are no definite avoidance areas where the placement of odor producing facilities associated with the 201 project would add to an already serious problem. Consequently, the odor impacts of 201 facilities can be judged on their own without reference to background conditions.

I.4 LAND

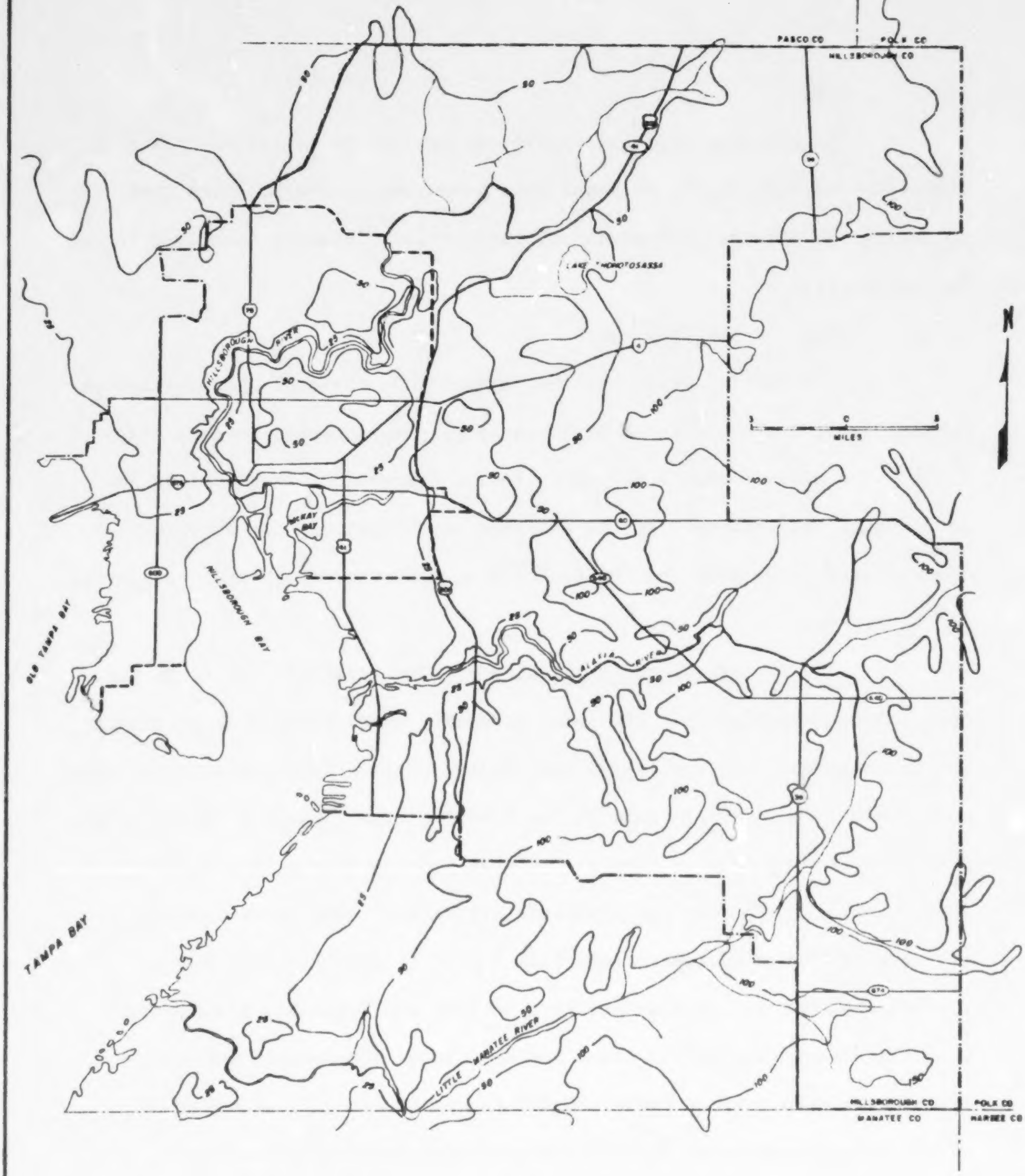
The Planning Area encompasses approximately 656 square miles on the north and east shores of Tampa Bay. Resources of the Planning Area including the physical, chemical and terrestrial biota are described in the following sections.

I.4.1 Physical and Chemical

This section describes the physical and chemical characteristics of the Planning Area in terms of topography, physiography, geology and soils. The major emphasis of the following discussions is placed on the areas which are important to the analysis of the primary and secondary impacts associated with the construction of wastewater treatment facilities in the region.

a. Topography and Physiography: The Planning Area is in the Gulf Coastal Physiographic Province, generally characterized by relatively gentle topography (Figure I.4-1) and limited physiographic variations. The Gulf Coastal Plain is divided, in the Planning Area, into two major physiographic regions, the Gulf Coastal Lowlands and the Central Highlands (Wright, 1974). The Central Highlands are further subdivided into the Hillsborough River Valley and the Polk Upland (Figure I.4-2). Major surface features in the Planning Area include the Tampa Bay System, and the Hillsborough and Alafia River Basins. These topographic and physiographic features reflect the geologic history of the region; especially those geologic events of the Pleistocene and Holocene (Recent).

The Gulf Coastal Lowland is relatively flat, with elevations between Mean Sea Level (MSL) along the coast to about 85 feet (MSL in the South Central Lowlands area. The majority of the lowland sections are somewhat poorly drained and characterized by swamps. In the


PASCO CO
POLK CO
HILLSBOROUGH CO
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MILES
LAKE THONOTOSASSA
HILLSBOROUGH RIVER
McKAY BAY
HILLSBOROUGH BAY
OLD TAMPA BAY
TAMPA BAY
ALAFIA RIVER
LITTLE MANATEE RIVER
25
50
100
HILLSBOROUGH CO
POLK CO
MANATEE CO
HARDEE CO

SOURCE: U.S. GEOLOGICAL SURVEY 1:250,000 SCALE - TAMPA, 1956-72
AND PLANT CITY, 1955-72

CENTRAL HILLSBOROUGH COUNTY - TAMPA
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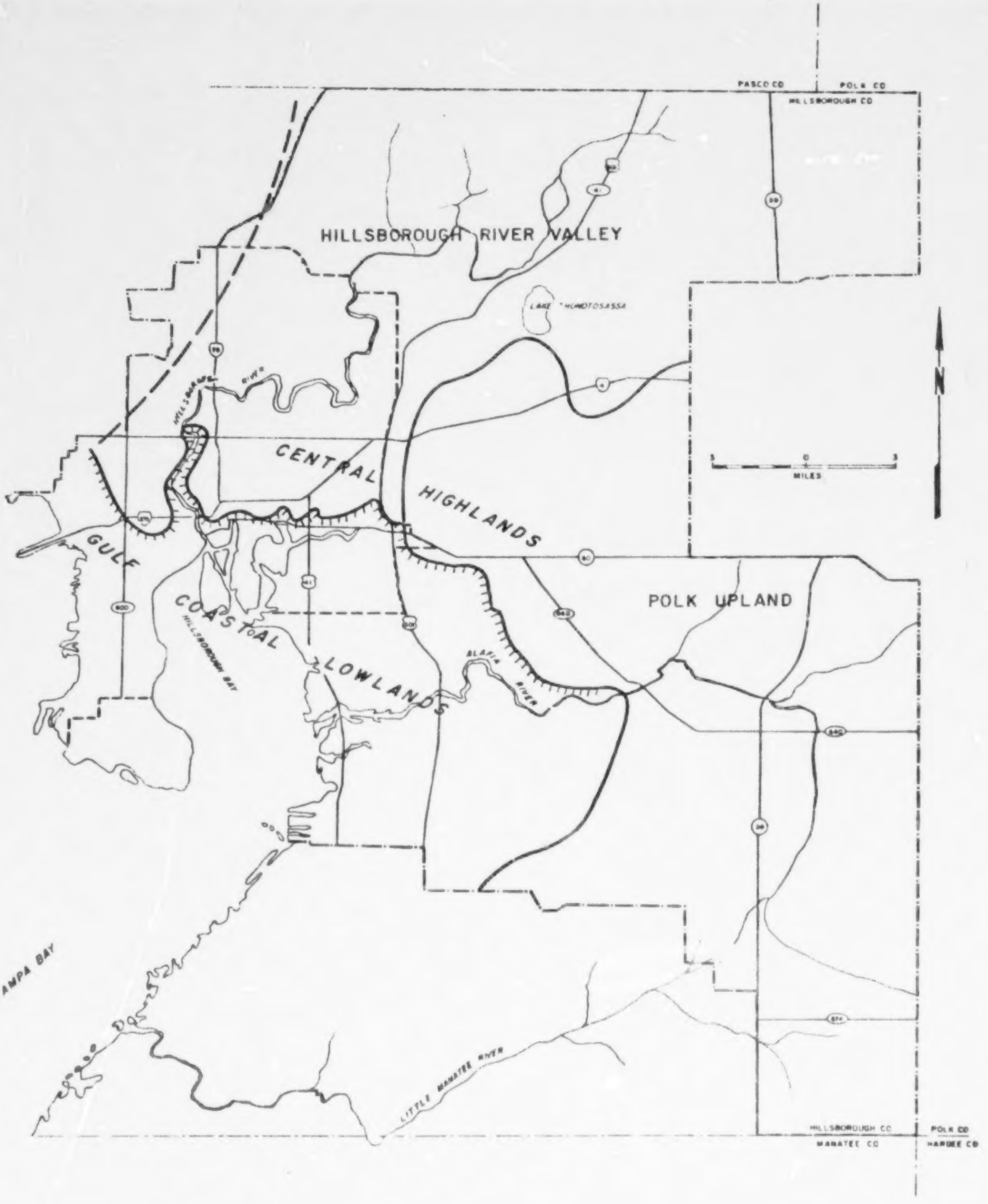
EPA No. C120634010

TOPOGRAPHY OF PLANNING AREA

DAMES & MOORE

FIGURE I 4-1

7896(1026 (9/78)


PASCO CO
POLK CO
HILLSBOROUGH CO
HILLSBOROUGH RIVER VALLEY
LAKE THONOTOSASSA
N
3 0 3
MILES
HILLSBOROUGH RIVER
CENTRAL HIGHLANDS
GULF COASTAL LOWLANDS
HILLSBOROUGH BAY
POLK UPLAND
ALAFIA RIVER
TAMPA BAY
LITTLE MANATEE RIVER
HILLSBOROUGH CO
MANATEE CO
POLK CO
HARDEE CO

SOURCE : WRIGHT, 1974 AND PURI & VERNON, 1964

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PHYSIOGRAPHY OF THE PLANNING AREA

DAMES & MOORE

FIGURE I.4-2

northwestern Tampa service area the lowlands are dotted by many lakes which are the southern tip of a chain of lakes that extends to the north. The topography of the lakes region is karstic, i.e., resultant from or modified by limestone solution features, and characterized by circular to oval shaped topographic depressions.

The Hillsborough River trends northeast to southwest, meandering through Hillsborough County and the City of Tampa, emptying into Hillsborough Bay. The river gradient is relatively gentle as shown in Figure I.4-3. The topographic basin drained by the Hillsborough River is shown in Figure I.4-4. The topography is swampy, sloping gently toward the coast ranging between 80 feet MSL to sea level at the Bay. Steeper slopes occur occasionally near the margins of the river flood plain (Figure I.4-5).

The Polk Upland, in the east, south and central sections of the Planning Area, is topographically higher than the adjacent physiographic areas previously described. The terrain is gently rolling to flat and is bounded on the west by a scarp (Pamlico Shoreline) at 30 feet MSL representing a Pleistocene sea level rise (Wright, 1974). The topography of the Polk Upland ranges in elevation from about 30 feet MSL to more than 100 feet MSL at the Hillsborough/Polk County line. The area is a moderately well drained, dissected upland, except in an area near Brandon, where a somewhat subdued karstic topography and internal drainage system exists.

The Alafia River basin has a network of swamps and tributaries which drain much of the southern portion of the Polk Upland and the southern portions of the Gulf Coastal Lowlands, emptying into the estuaries of Hillsborough and Tampa Bays. As with the Hillsborough River, the stream gradient is relatively gentle (Figure I.4-3) with steeper topographic slopes occurring occasionally near the floodplain margins (Figure I.4-5).

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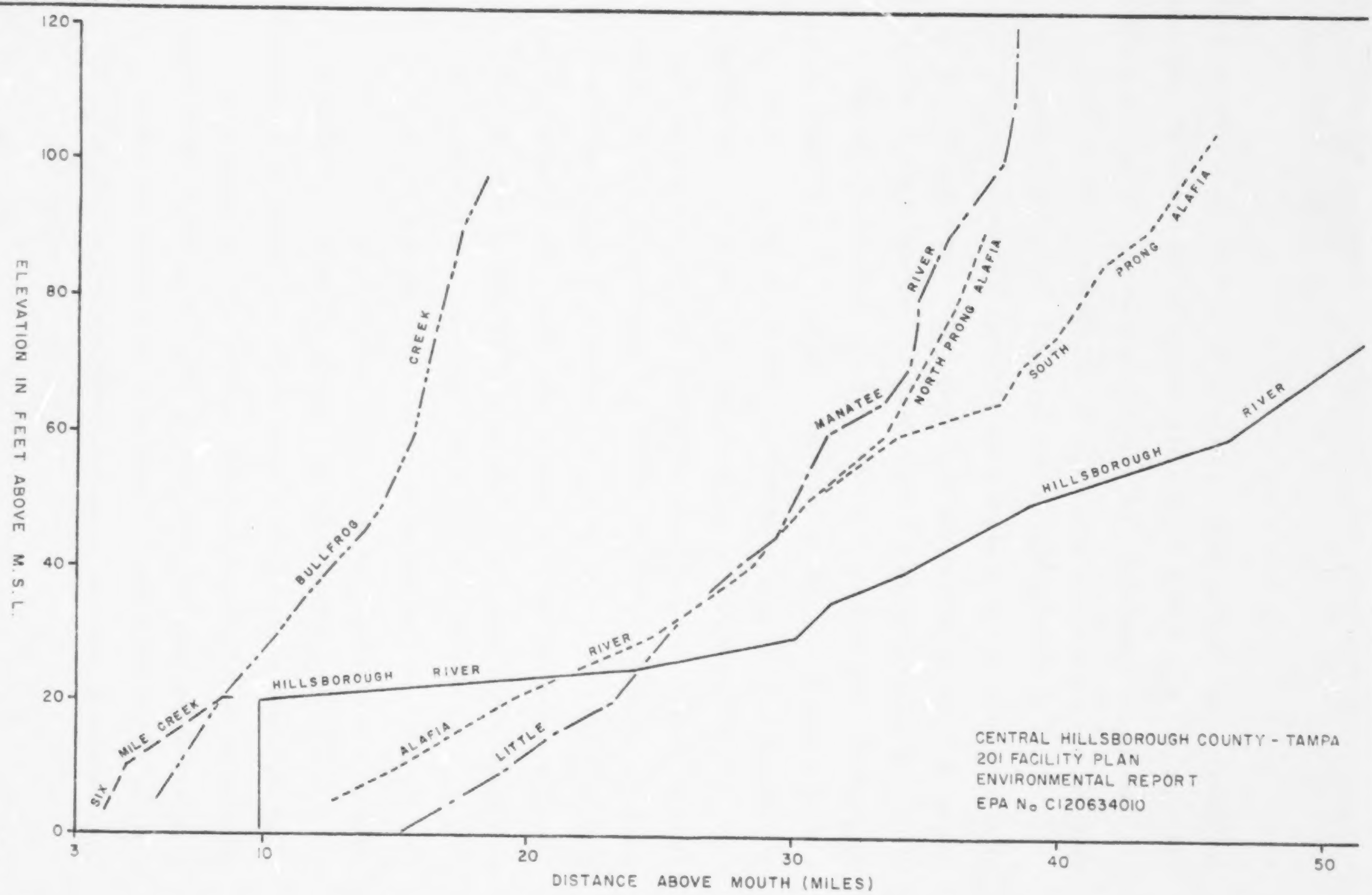

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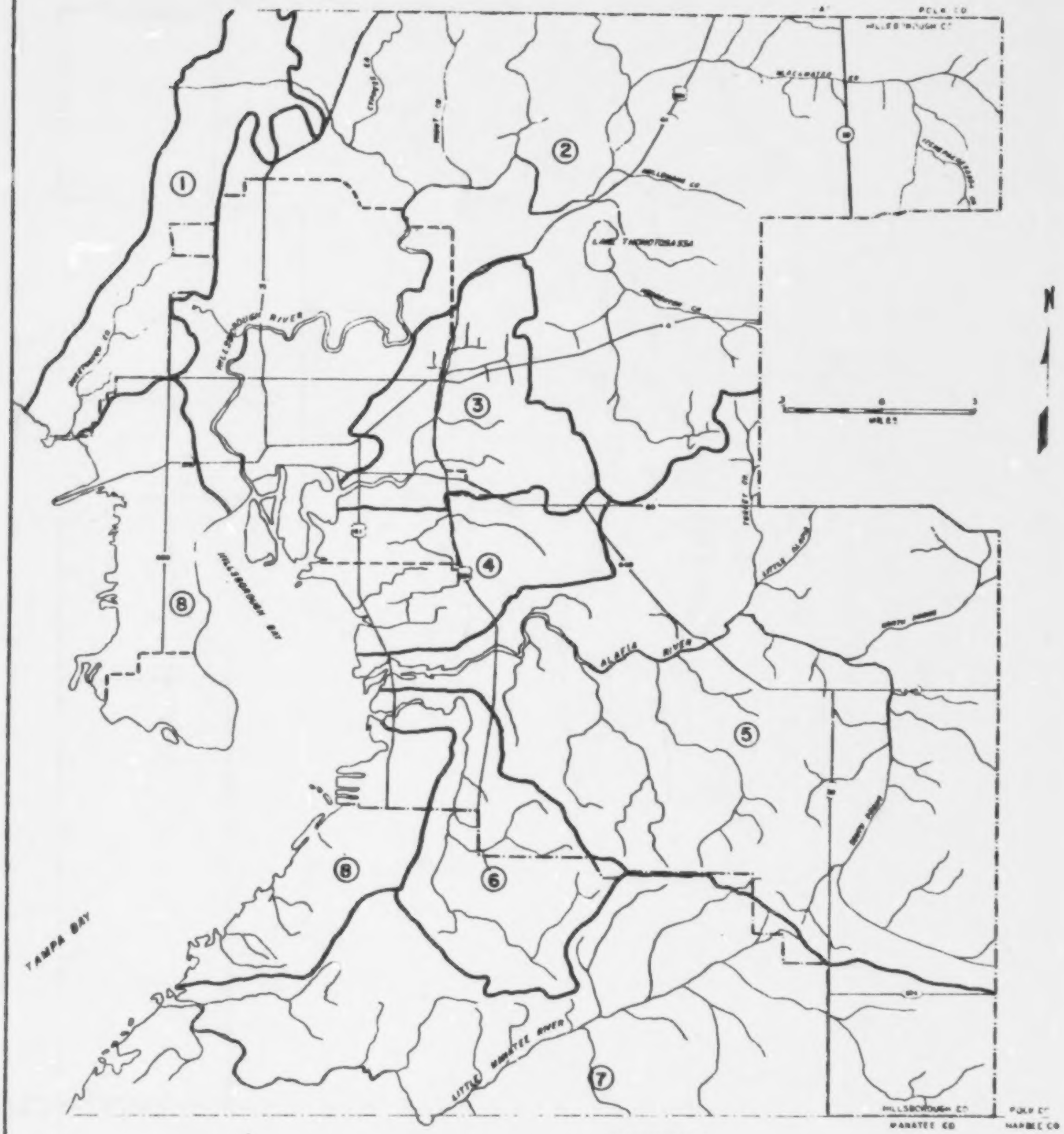
RIVER - CREEK PROFILES IN HILLSBOROUGH COUNTY

SOURCE: MENKE, et al, 1961

DAMES & MOORE
FIGURE I.4-3


POLK CO
HILLSBOROUGH CO
BLACKWATER CR
CYPRESS CR
TROUT CR
LAKE THONOTOSASSA
HILLSBOROUGH RIVER
SWEETWATER CR
HILLSBOROUGH BAY
TAMPA BAY
ALAFIA RIVER
LITTLE ALAFIA
NORTH PRONG
SOUTH PRONG
LITTLE MANATEE RIVER
HILLSBOROUGH CO
POLK CO
MANATEE CO
HARDEE CO
N
2 0 2
MILES
①
②
③
④
⑤
⑥
⑦
⑧
⑧

KEY:
DRAINAGE BASIN BOUNDARY

DRAINAGE BASINS:

① SWEETWATER CREEK
② HILLSBOROUGH RIVER
③ PALM RIVER / SIXMILE CREEK
④ DELANEY CREEK
⑤ ALAFIA RIVER
⑥ BULLFROG CREEK
⑦ LITTLE MANATEE RIVER
⑧ COASTAL STREAMS

SOURCE: HILLSBOROUGH COUNTY PLANNING COMMISSION, 1974, WRIGHT, 1974, DAMES & MOORE, 1979; SMITH & GILLESPIE, GREELEY & HANSEN, 1979

CENTRAL HILLSBOROUGH COUNTY - TAMPA
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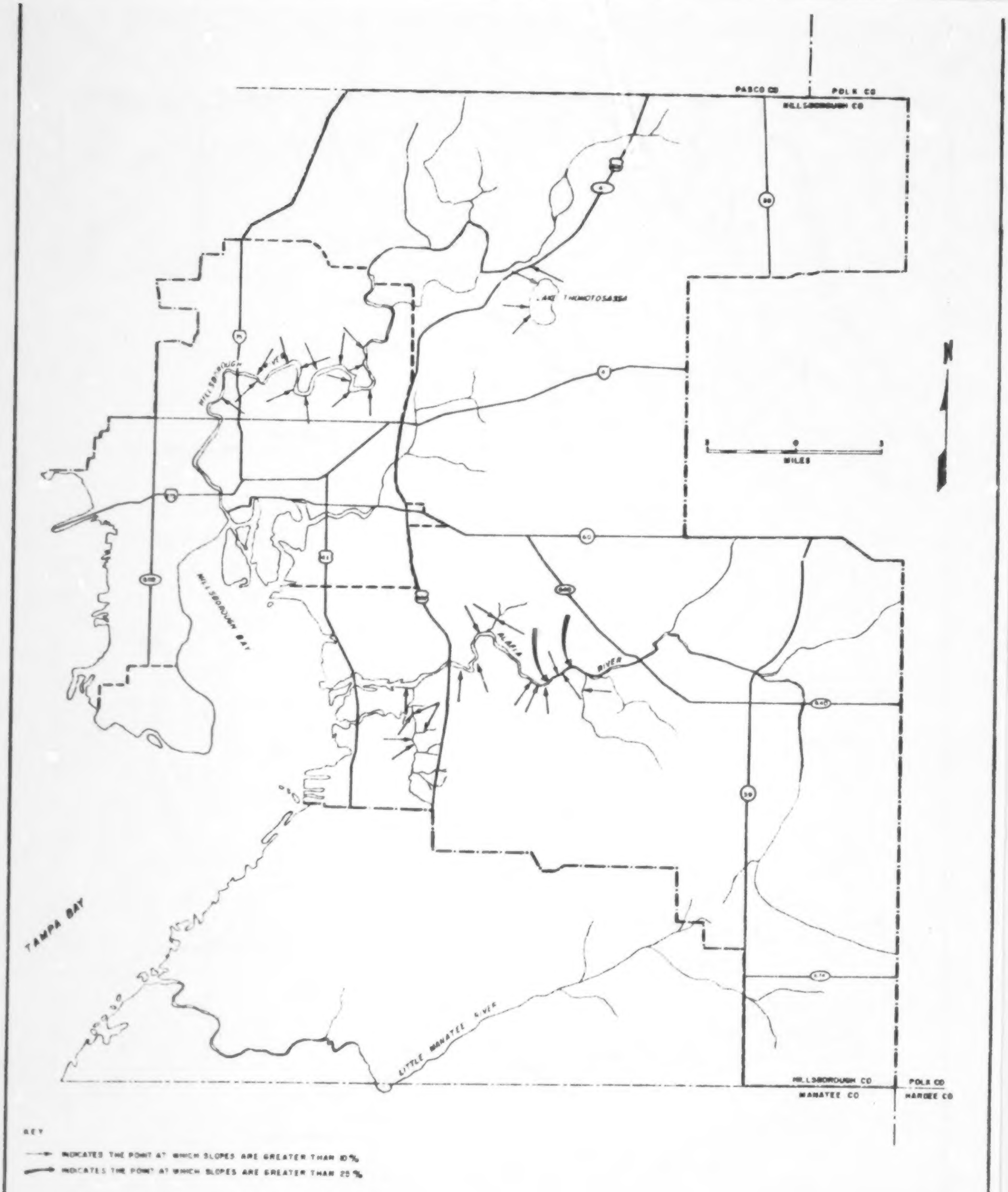
DRAINAGE BASINS IN PLANNING AREA

DAMES & MOORE

FIGURE I.4-4


PASCO CO
POLK CO
HILLSBOROUGH CO
LAKE THONOTOSASSA
HILLSBOROUGH RIVER
N
MILES
4
60
640
39
674
41
580
HILLSBOROUGH BAY
ALAFIA RIVER
TAMPA BAY
LITTLE MANATEE RIVER
HILLSBOROUGH CO
POLK CO
MANATEE CO
HARDEE CO
KEY
INDICATES THE POINT AT WHICH SLOPES ARE GREATER THAN 10%
INDICATES THE POINT AT WHICH SLOPES ARE GREATER THAN 25%

SOURCE: U.S. GEOLOGICAL SURVEY 1:24,000 SCALE, 5 FEET CONTOUR INTERVAL,
TOPOGRAPHIC 7.5 MIN QUADRANGLE MAPS

CENTRAL HILLSBOROUGH COUNTY - TAMPA
201 FACILITY PLAN
ENVIRONMENTAL REPORT
EPA No. C120634010

LOCATION OF TOPOGRAPHIC SLOPES GREATER THAN TEN PERCENT

DAMES & MOORE

FIGURE I.4-5

Geology: The Planning Area is underlain by more than 8,000 feet of Cenozoic sedimentary material which rests on crystalline basement. The Cenozoic sedimentary material consists primarily of limestone, dolostone, clay and sand (Menke, et al., 1961). Eocene and younger units comprise the major geologic resources of the Planning Area. Table I.4-1 presents a brief description of the units and indicates their hydrogeologic significance. Further discussion of hydrogeology is presented below.

The following discussion of the geologic framework of the Planning Area includes the Eocene-Oldsmar, Lake City, Avon Park limestones, the Oligocene Suwannee limestone, the Miocene Tampa limestone and Hawthorn Formation and the surface undifferentiated sands and clays. These geologic units form a wedge shaped section of sedimentary material which generally thickens and dips towards the coast. The relationship, relative thickness and attitude of the units is presented in a series of geologic cross-sections (Figure I.4-6) and structure maps (Figure I.4-7).

The Eocene geologic units underlying the Planning Area are the Oldsmar limestone, the Lake City limestone, and the Ocala Group.

The Oldsmar limestone is deeply buried and is generally not penetrated by wells in the Planning Area. Owing to its depth and limited value as a ground-water resource, comparatively little is known about the Oldsmar limestone.

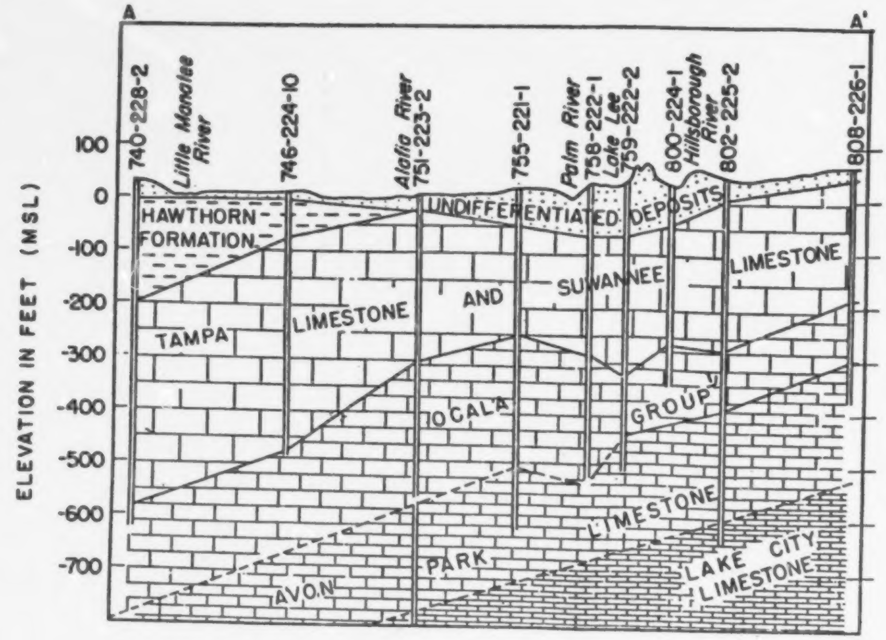
The overlying Eocene units (the Lake City and the Avon Park limestones) are generally the oldest and deepest geologic units which may be considered to be of major importance in terms of water resources. The Lake City and Avon Park limestones are a thick sequence of carbonate sediments, consisting of limestones and dolomitic limestone. Gypsum and other evaporite minerals may occur in the deeper portions of the formations

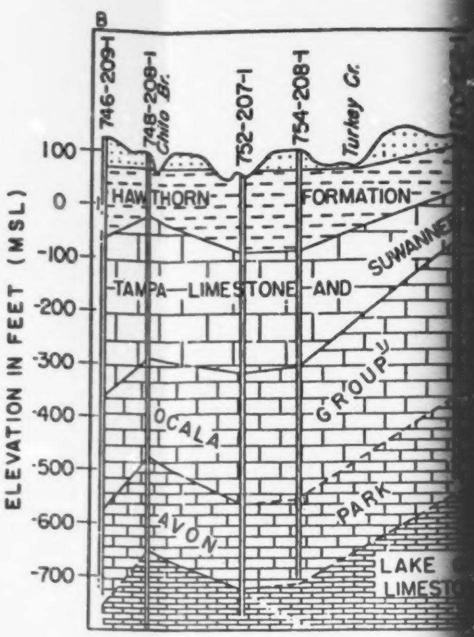
TABLE I.4-1

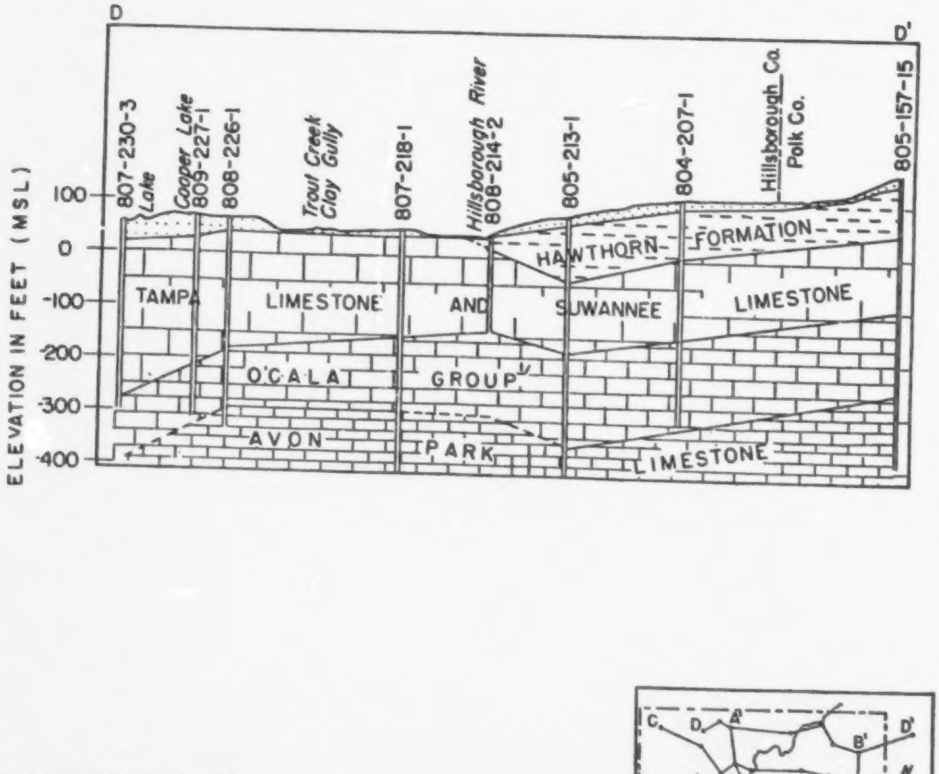
SUMMARY OF CENOZOIC FORMATIONS

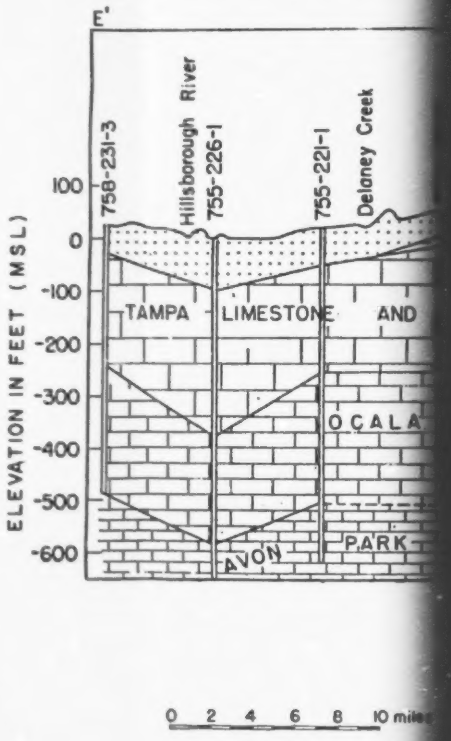
Era	Series	Formation	Thickness	Lithology	Water Supply	Aquifer
Cenozoic	Pleistocene and Holocene (Recent)	Undifferentiated	0-150	Sand, clay, and marl.	Sand yields up to 200 gpm in some areas and generally 5 to 10 gpm to driven wells less than 40 feet deep. Clay and marl do not yield usable quantities of water to wells.	Water table aquifer
	Pliocene					
	Miocene	Hawthorn formation	0-250	Clay, sand, and limestone. Limestone, near bottom of formation, is white to gray, soft, sandy, and porous.	Limestone member yields up to 200 gpm.	Principal confining bed/secondary artesian aquifer
		Tampa limestone	80-400	White, cream, and gray, hard to soft, sandy limestone. Many molds of pelecypods and gastropods.	Yields up to 1,000 gpm. Supplies most domestic and commercial wells in county.	Principal artesian
	Oligocene	Suwannee limestone		White, yellow, and light brown, soft to hard, dense, fine-grained limestone with chert lenses to 25 feet thick.		
	Eocene	Ocala group[1] Crystal River formation (Puri, 1957) Williston formation (Puri, 1957 Inglis limestone	90-300	Yellow-gray and brown soft, almost pure limestone. Mostly foraminiferal coquinas in pasty limestone matrix.	Rarely used for water supply because of low transmissibility.	
		Avon Park limestone	200+	Soft, chalky, cream to brown limestone containing beds of foraminiferal coquina and zones of brown to dark brown, hard, crystalline dolomitic limestone. Locally contains some gypsum.	Principal source of supply for wells yielding more than 500 gpm. Yield exceeds 5,000 gpm in some wells.	
		Lake City limestone	500			
		Oldsmar limestone	900	Fragmental dolomitic limestone with lenses of chert, thin shale beds and some gypsum.	Not used for water supplies but is potential source of fresh water in north-central and northeastern part of county.	

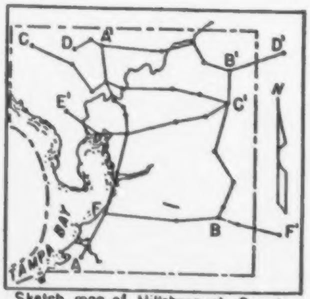
SOURCE : MENKE ET AL., 1961


A
A'
ELEVATION IN FEET (MSL)
100
0
-100
-200
-300
-400
-500
-600
-700
740-228-2
Little Manatee River
746-224-10
Alafia River
751-223-2
755-221-1
Palm River
758-222-1
Lake Lee
759-222-2
800-224-1
Hillsborough River
802-225-2
808-226-1
HAWTHORN FORMATION
UNDIFFERENTIATED DEPOSITS
TAMPA
LIMESTONE
AND
SUWANNEE
LIMESTONE
OCALA
GROUP
AVON
PARK
LIMESTONE
LAKE CITY LIMESTONE


B
ELEVATION IN FEET (MSL)
100
0
-100
-200
-300
-400
-500
-600
-700
746-209-1
748-208-1
Chito Br.
752-207-1
754-208-1
Turkey Cr.
HAWTHORN
FORMATION
TAMPA
LIMESTONE
AND
SUWANNEE
OCALA
GROUP
AVON
PARK
LAKE
LIMESTO


D
D'
ELEVATION IN FEET (MSL)
100
0
-100
-200
-300
-400
807-230-3
Lake
Cooper Lake
809-227-1
808-226-1
Trout Creek
Clay Gully
807-218-1
Hillsborough River
808-214-2
805-213-1
804-207-1
Hillsborough Co.
Polk Co.
805-157-15
HAWTHORN
FORMATION
TAMPA
LIMESTONE
AND
SUWANNEE
LIMESTONE
OCALA
GROUP
AVON
PARK
LIMESTONE


E'
ELEVATION IN FEET (MSL)
100
0
-100
-200
-300
-400
-500
-600
758-231-3
Hillsborough River
755-226-1
755-221-1
Delaney Creek
TAMPA
LIMESTONE
AND
OCALA
AVON
PARK
0
2
4
6
8
10 miles


C
D
A'
B'
D'
E'
C'
N
TAMPA BAY
E
B
F'
A

Sketch map of Hillsborough County showing the location of cross sections.

SOURCE: MENKE, et al., 1961.

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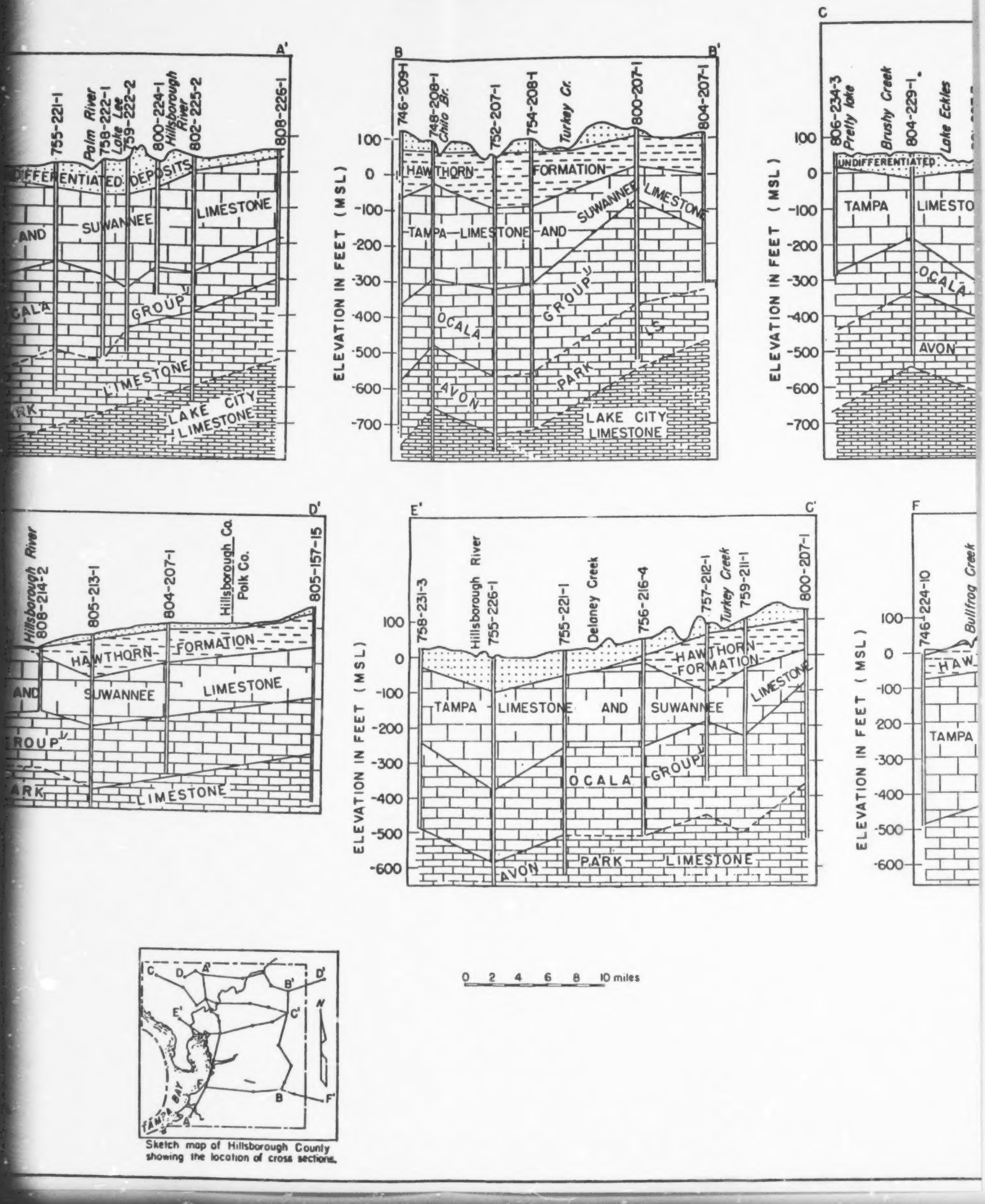
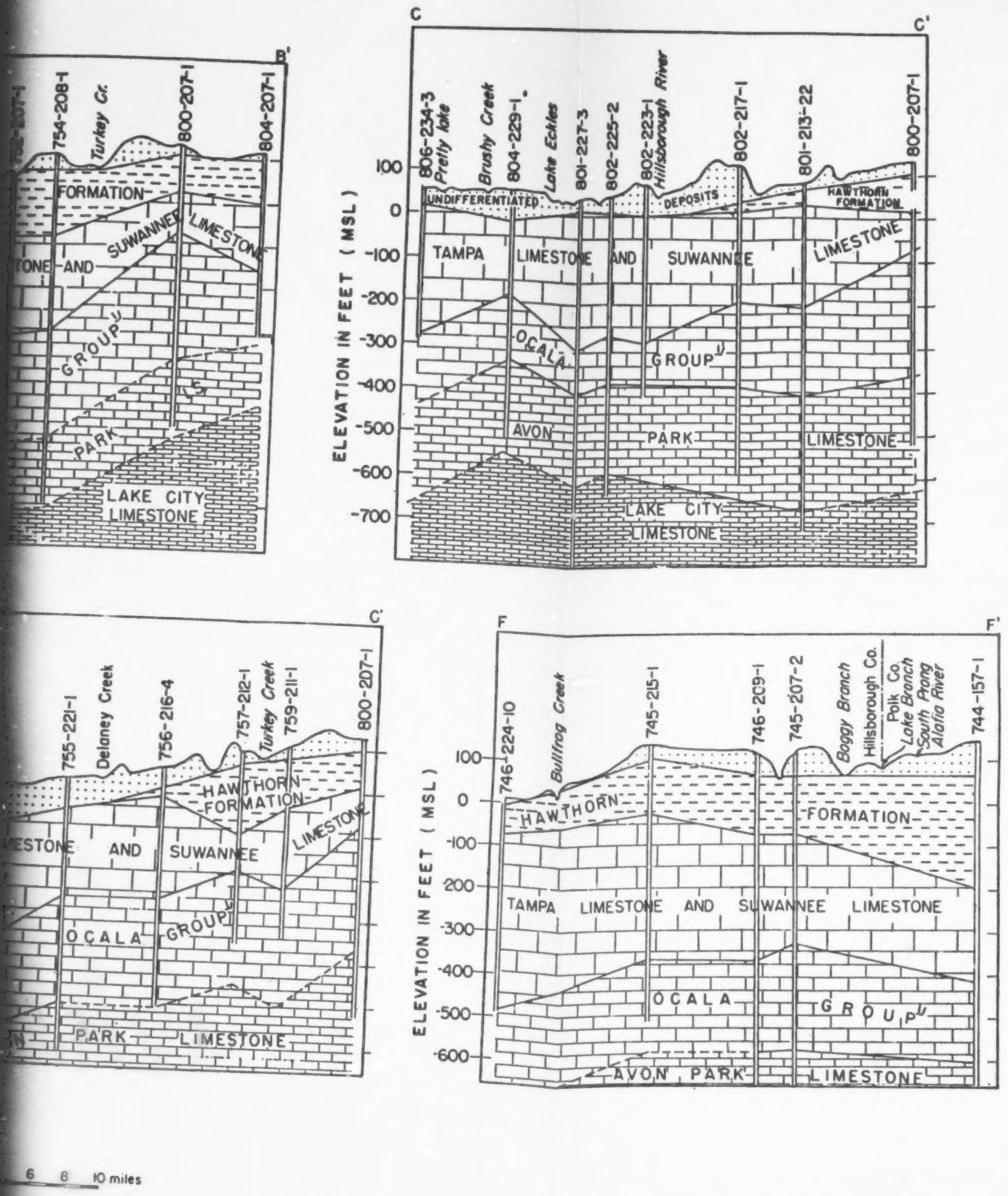

A'
755-221-1
Palm River
758-222-1
Lake Lee
759-222-2
800-224-1
Hillsborough River
802-225-2
808-226-1
UNDIFFERENTIATED DEPOSITS
AND
SUWANNEE
LIMESTONE
OCALA
GROUP
PARK
LIMESTONE
LAKE CITY LIMESTONE
B
B'
746-209-1
748-208-1
Chilo Br.
752-207-1
754-208-1
Turkey Cr.
800-207-1
804-207-1
HAWTHORN
FORMATION
TAMPA LIMESTONE AND SUWANNEE LIMESTONE
OCALA
GROUP
AVON
PARK
LS.
LAKE CITY LIMESTONE
ELEVATION IN FEET (MSL)
100
0
-100
-200
-300
-400
-500
-600
-700
C
806-234-3
Pretty lake
Brushy Creek
804-229-1
Lake Eckles
UNDIFFERENTIATED
TAMPA
LIMESTO
OCALA
AVON
D'
Hillsborough River
808-214-2
805-213-1
804-207-1
Hillsborough Co.
Polk Co.
805-157-15
HAWTHORN
FORMATION
AND
SUWANNEE
LIMESTONE
GROUP
PARK
LIMESTONE
E'
C'
758-231-3
Hillsborough River
755-226-1
755-221-1
Delaney Creek
756-216-4
757-212-1
Turkey Creek
759-211-1
800-207-1
HAWTHORN FORMATION
TAMPA
LIMESTONE
AND
SUWANNEE
LIMESTONE
OCALA
GROUP
AVON
PARK
LIMESTONE
F
746-224-10
Bullfrog Creek
HAW
TAMPA
0 2 4 6 8 10 miles
C
D
A'
D'
B'
E'
C'
N
TAMPA BAY
F
B
F'
A

Sketch map of Hillsborough County showing the location of cross sections.

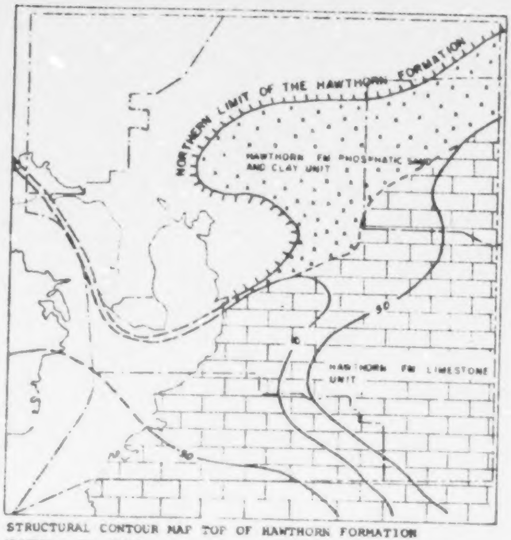

B'
754-208-1
Turkey Cr.
800-207-1
804-207-1
FORMATION
SUWANNEE
LIMESTONE
TONE AND
GROUP 1/
PARK
L.S.
LAKE CITY
LIMESTONE
C
C'
806-234-3
Pretty lake
Brushy Creek
804-229-1
Lake Eckles
801-227-3
802-225-2
802-223-1
Hillsborough River
802-217-1
801-213-22
800-207-1
UNDIFFERENTIATED
DEPOSITS
HAWTHORN FORMATION
TAMPA
LIMESTONE AND
SUWANNEE
LIMESTONE
OCALA
GROUP 1/
AVON
PARK
LIMESTONE
LAKE CITY
LIMESTONE
ELEVATION IN FEET (MSL)
100
0
-100
-200
-300
-400
-500
-600
-700
C'
755-221-1
Delaney Creek
756-216-4
757-212-1
Turkey Creek
759-211-1
800-207-1
HAWTHORN
FORMATION
ESTONE AND
SUWANNEE
LIMESTONE
OCALA
GROUP 1/
PARK
LIMESTONE
F
F'
746-224-10
Bullfrog Creek
745-215-1
746-209-1
745-207-2
Boggy Branch
Hillsborough Co.
Polk Co.
Lake Branch
South Prong
Alafia River
744-157-1
HAWTHORN
FORMATION
TAMPA
LIMESTONE AND
SUWANNEE
LIMESTONE
OCALA
GROUP 1/
AVON PARK
LIMESTONE
ELEVATION IN FEET (MSL)
100
0
-100
-200
-300
-400
-500
-600
6
8
10 miles

GEOLOGIC CROSS SECTIONS THROUGH
HILLSBOROUGH COUNTY, FLORIDA

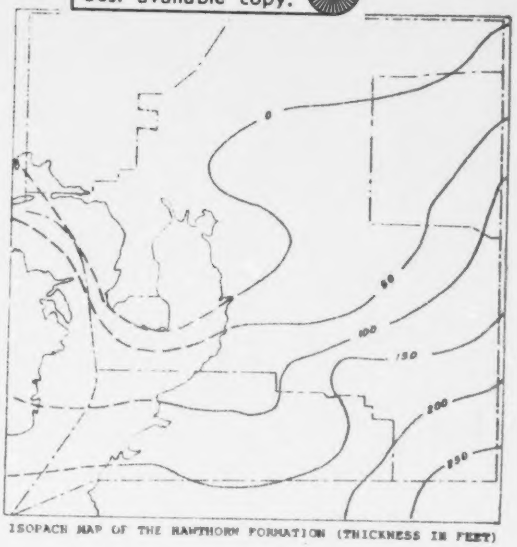
I-69

DAMES & MOORE
FIGURE I.4-6

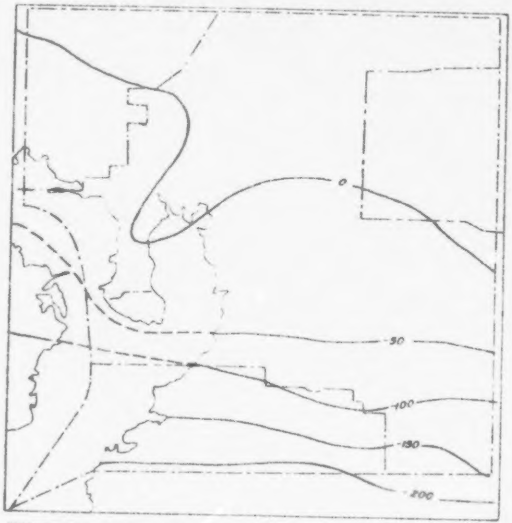
Reproduced from best available copy.


NORTHERN LIMIT OF THE HAWTHORN FORMATION
HAWTHORN FM PHOSPHATIC SAND AND CLAY UNIT
HAWTHORN FM LIMESTONE UNIT
50
0
50

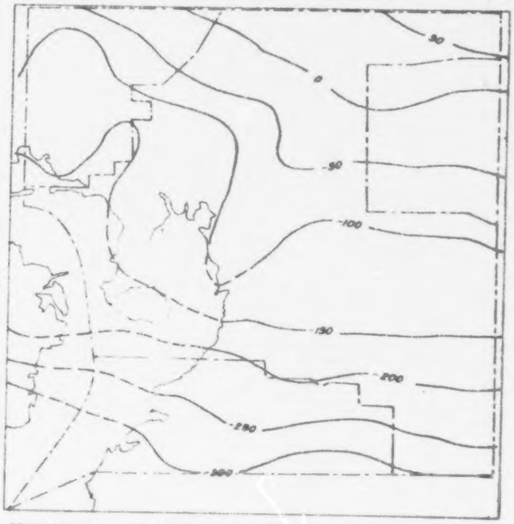
STRUCTURAL CONTOUR MAP TOP OF HAWTHORN FORMATION
(DATUM = FT. MSL)


0
50
100
150
200
250

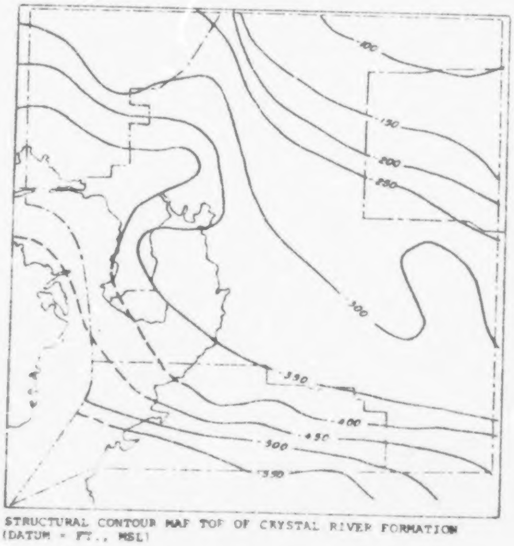
ISOPACH MAP OF THE HAWTHORN FORMATION (THICKNESS IN FEET)


0
-50
-100
-150
-200

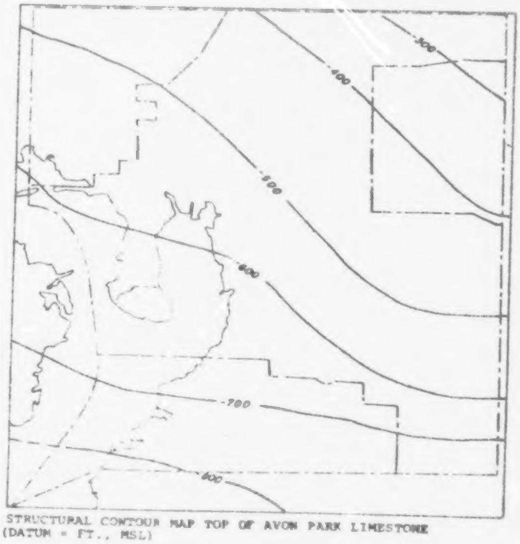
STRUCTURAL CONTOUR MAP TOP OF TAMPA LIMESTONE
(DATUM = FT., MSL)


50
0
-50
-100
-150
-200
-250
-300

STRUCTURAL CONTOUR MAP TOP OF SUWANNEE LIMESTONE
(DATUM = FT., MSL)


-100
-150
-200
-250
-300
-350
-400
-450
-500
-550

STRUCTURAL CONTOUR MAP TOP OF CRYSTAL RIVER FORMATION
(DATUM = FT., MSL)


-300
-400
-500
-600
-700
-800

STRUCTURAL CONTOUR MAP TOP OF AVON PARK LIMESTONE
(DATUM = FT., MSL)

0 10 20 30
MILES

SUBSURFACE GEOLOGY OF THE HILLSBOROUGH COUNTY AREA

SOURCE: FLORIDA BUREAU OF GEOLOGY UNPUBLISHED DATA 1979 & THRUSH ? AND CARR W.J. AND ALVERSON, D.C. 1959

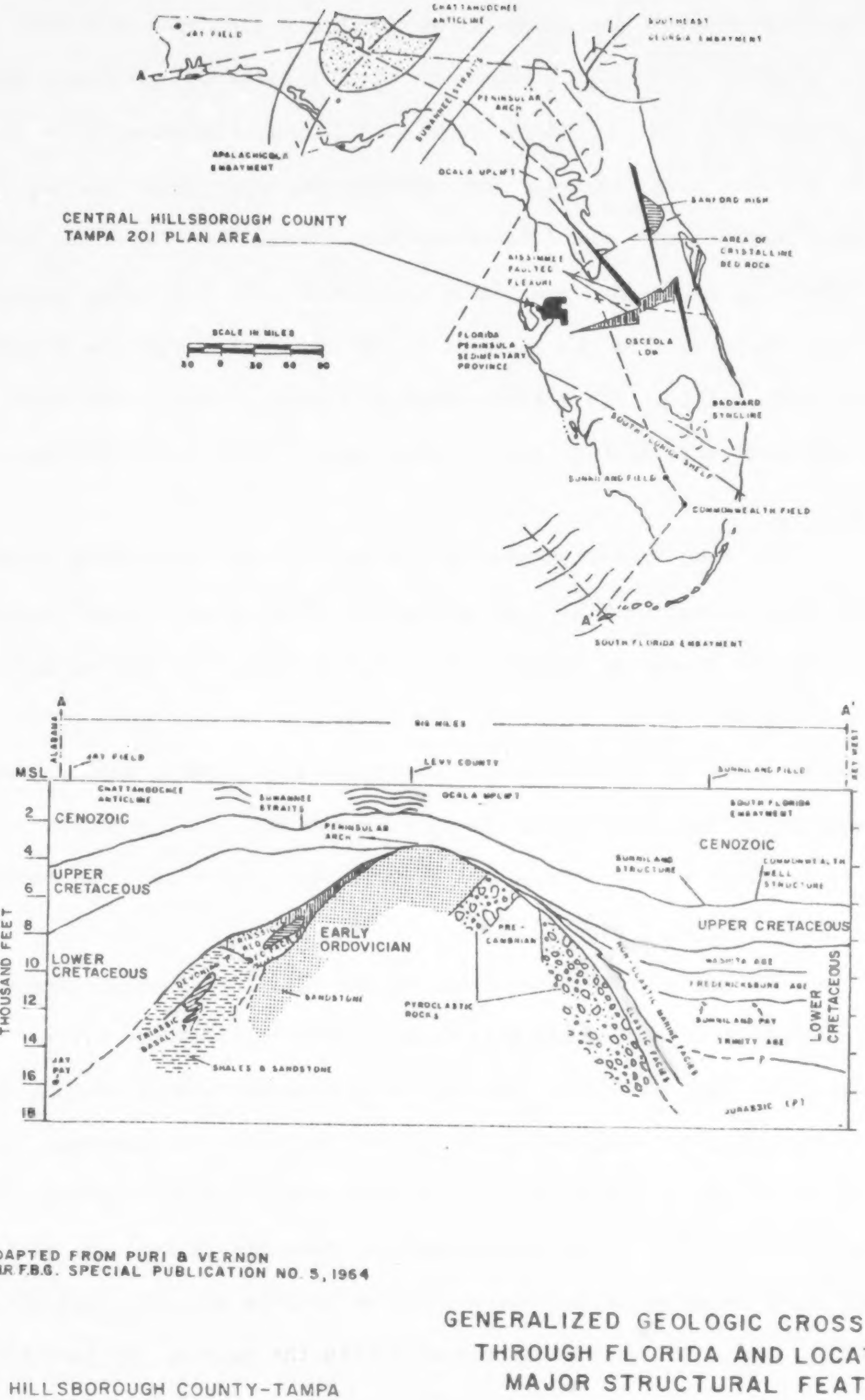
DAMES & MOORE

FIGURE I.4-7

and indicate the presence of highly mineralized (non-potable) connate waters. The depth of the evaporite occurrence varies from -900 feet MSL in the north to -1400 MSL in the south part of Hillsborough County (USGS unpublished data, 1979). Thick zones of dolomitic limestone often occur within the Avon Park limestone and comprise the major water bearing zones in these Eocene limestones. These massive, crystalline dolomitic zones are brittle in nature and are highly fractured. The fracturing probably resulted, in part, from the tectonic events associated with the development of the Ocala Uplift. The uplift, shown in Figure I.4-8, is the major regional structural feature and has strongly influenced the regional geology.

The Avon Park limestone is overlain by the Ocala Group which consist of the Inglis, Williston and Crystal formations. These formations are dominantly limestone of moderate to low permeability and are generally not utilized as a water resource. The upper part of the Ocala Group is thought to restrict, to some degree, vertical ground-water movement between the more permeable units which lie above and below. This vertical restriction is lessened by the presence of solution openings within the Ocala Group (Menke, et al., 1961).

The Ocala Group is overlain by the Oligocene Suwannee limestone. The Suwannee limestone consists of relatively pure limestone but may contain thick beds of chert. The overlying Miocene Tampa limestone is not easily distinguished stratigraphically from the Suwannee limestone and the two units may be considered as a somewhat discrete hydrogeologic unit (Menke, et al., 1961). The Tampa-Suwannee limestone is the uppermost unit of the thick sequence of carbonate rocks which form the principal artesian aquifer. The unit outcrops at places within the county, but commonly


CHATTAHOOCHEE ANTICLINE
SOUTHEAST GEORGIA EMBAYMENT
JAY FIELD
A
SUWANNEE STRAITS
PENINSULAR ARCH
APALACHICOLA EMBAYMENT
OCALA UPLIFT
SANFORD HIGH
CENTRAL HILLSBOROUGH COUNTY
TAMPA 201 PLAN AREA
AREA OF CRYSTALLINE BED ROCK
KISSIMMEE FAULTED FLEXURE
SCALE IN MILES
30 0 30 60 90
FLORIDA PENINSULA SEDIMENTARY PROVINCE
OSCEOLA LOW
BROWARD SYNCLINE
SOUTH FLORIDA SHELF
SUNNILAND FIELD
COMMONWEALTH FIELD
A'
SOUTH FLORIDA EMBAYMENT
A
A'
515 MILES
ALABAMA
KEY WEST
MSL
JAY FIELD
LEVY COUNTY
SUNNILAND FIELD
CHATTAHOOCHEE ANTICLINE
SUWANNEE STRAITS
OCALA UPLIFT
SOUTH FLORIDA EMBAYMENT
PENINSULAR ARCH
THOUSAND FEET
2
4
6
8
10
12
14
16
18
CENOZOIC
UPPER CRETACEOUS
LOWER CRETACEOUS
CENOZOIC
SUNNILAND STRUCTURE
COMMONWEALTH WELL STRUCTURE
UPPER CRETACEOUS
EARLY ORDOVICIAN
TRIASSIC
DEVONIAN
TRIASSIC BASALT
SANDSTONE
SHALES & SANDSTONE
PRE-CAMBRIAN
PYROCLASTIC ROCKS
NON-CLASTIC MARINE FACIES
CLASTIC FACIES
WASHITA AGE
FREDERICKSBURG AGE
SUNNILAND PAY
TRINITY AGE
LOWER CRETACEOUS
JAY PAY
JURASSIC (P)

SOURCE: ADAPTED FROM PURI & VERNON
DNR.F.B.G. SPECIAL PUBLICATION NO. 5, 1964

GENERALIZED GEOLOGIC CROSS-SECTION THROUGH FLORIDA AND LOCATION OF MAJOR STRUCTURAL FEATURES

CENTRAL HILLSBOROUGH COUNTY-TAMPA
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ENVIRONMENTAL REPORT
EPA No. C120634010

DAMES & MOORE
FIGURE I.4-8

is immediately overlain by the younger Hawthorn Formation or by undifferentiated sands and clays (Menke, et al., 1961).

The hydrogeology of the Miocene Tampa and Oligocene Suwannee limestones, as well as the previously described Eocene carbonate units, is influenced by structural features. Permeable fracture zones and joints occur along which percolating ground waters dissolve the limestone. The development of fracture related solution features is a major factor in determining the overall effective permeability of the unit and thus, its ability to supply large quantities of ground water. Development of these solution features is in part dependent on the nature and extent of the sediments that overlie the carbonates.

Fine grained, low permeability sediments, principally of the Hawthorn Formation, overlie the Tampa limestone over most of the Planning Area. These fine grained sediments serve to confine the underlying principal artesian aquifer. The confining bed thickness is greater in the southeast portion of the Planning Area, being thinnest in the Hillsborough River Valley (USGS unpublished data, 1979).

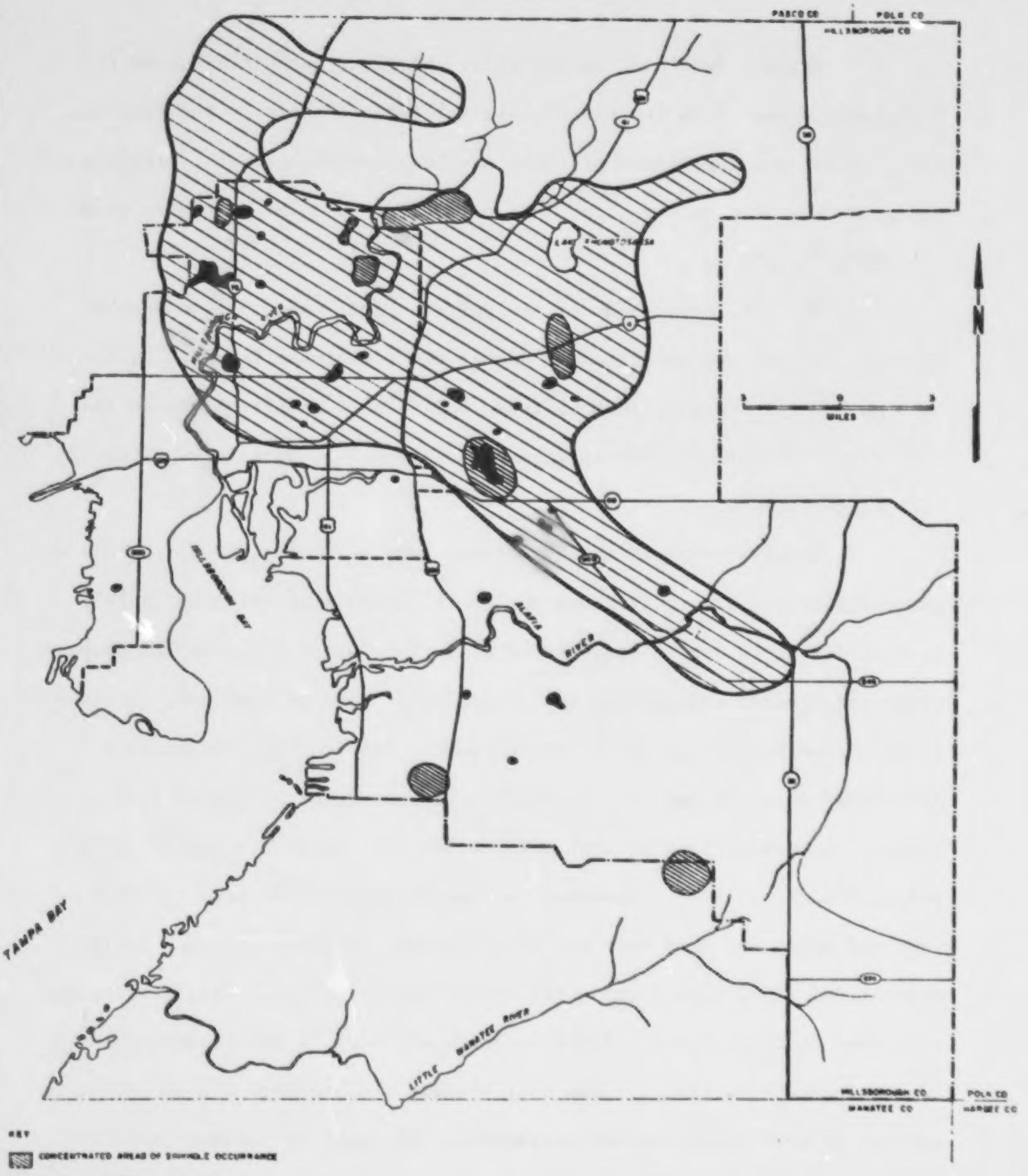
A surface blanket of porous sands overlies the confining bed over the majority of area. These sands range from less than 25 feet in the river valleys to more than 50 feet in topographically high areas (USGS unpublished data, 1979). The surface sands, principally Pliestocene to Holocene (Recent) in age, comprise the water table aquifer (Menke, et al., 1961).

Sinkholes: Sinkhole or karst topography is surficial evidence of geochemical reactions between ground water and carbonate rocks. Karst features, such as swamps, cypress domes and sinkhole lakes have developed in the Tampa limestone, because of its high permeability, is susceptible to dissolution. According to Wright (1974), "Many solution cavities, sinkholes and collapse structures occur in the formation, especially where it lies near the surface".

Hydrologic conditions influence sinkhole development. Where the gradient (difference in water surface elevation) between the water table aquifer and the underlying artesian aquifer is relatively high, the likelihood of sinkhole occurrence increases. This condition commonly exists in areas of high ground-water withdrawal where the potentiometric surface of the artesian aquifer has been lowered. Other factors which may contribute to sinkhole development include increased loading of the overlying sediments due to buildings or fill material.

In general, karst features in the Tampa Bay area occur along a northwest-southeast trend. Although it is thought that the presence of solution features is related to the regional geologic structure, no clear pattern of development has been discovered. As a result, accurate prediction of specific areas of potential collapse is difficult. Figure I.4-9 indicates general areas where sinkholes and subsurface cavities occur. In these zones, hydrologic, geologic and soil conditions are potentially favorable for sinkhole development.

Not only is there potential for property damage from sinkhole formation and subsidence, but there is also increased possibility of pollution of ground-water supplies in karstic terrain. Surface water or ground water from the water table aquifer may enter the artesian aquifer through sinkholes. Examples of such occurrences are the "Blue Sink" area which captures the flow of Curiosity Creek and the Brandon area where recharge waters enter the artesian aquifer through the overlying sediments (personal communication 1979, L. Hall, S. Metcalf).


PASCO CO
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LAKE THONOTOSASSA
HILLSBOROUGH RIVER
HILLSBOROUGH BAY
ALAFIA RIVER
TAMPA BAY
LITTLE MANATEE RIVER
N
MILES
HILLSBOROUGH CO
POLK CO
MANATEE CO
HARDEE CO

KEY

▨ CONCENTRATED AREAS OF SINKHOLE OCCURRANCE

■ AREAS OF SUBSURFACE CAVITIES

▧ GENERALIZED AREAS OF SINKHOLE OCCURRANCE

SOURCES: WRIGHT, A.P. 1974; U.S. GEOLOGICAL SURVEY TOPOGRAPHIC MAP SERIES,
U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE, 1958,
HILLSBOROUGH COUNTY PLANNING COMMISSION, 1974;
U.S. GEOLOGICAL SURVEY UNPUBLISHED DATA, 1976.

SINKHOLE PRONE AREAS

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EPA No C120634010

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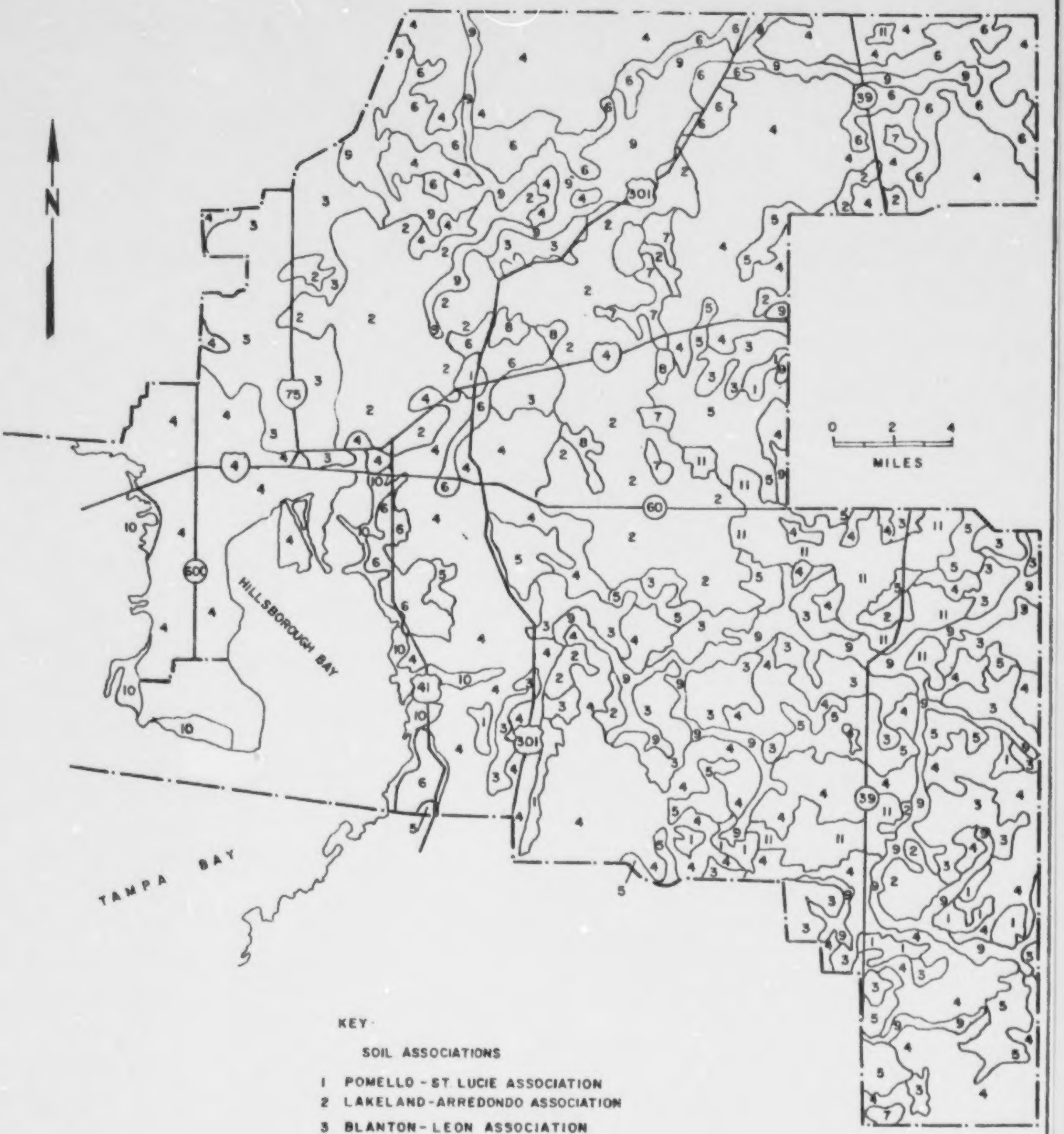
FIGURE I.4-9

Soils: Surficial sands, silts and clays deposited during the Pleistocene epoch form the parent material for the soils in the Planning Area. Since the deposition of these surficial sediments, the climate and topography as well as the plant and animal life have interacted to produce the soils found today.

The U.S. Department of Agriculture, Soil Conservation Service (SCS) has mapped and described in detail the soil types found in Hillsborough County. Descriptions of these soils and the suitability of the soil types for various uses is presented in the SCS, Hillsborough County Soil Survey (1969).

Detailed maps of the soil types have been combined to produce a generalized soil association map for the Planning Area (Figure I.4-10). Each soil association is composed of soil types which have similar properties, texture and suitability for a particular type of land use. Limitations or suitability of soils for particular land use activities were determined from SCS and the Florida Health Department standards (Table I.4-2). Determinations of soil limitations are based on a number of soil parameters (SCS, 1969). However, the key suitability factors for most of the soil types and land uses are flood hazard and depth to water table. Generalized flood hazard and water table classes for each soil association are shown on Table I.4-2. Soils which do not violate health department regulations are suitable, those that violate one standard are questionable and two or more standards are unsuitable. Although variations in flood hazard and water table occur betwen the main soil types within an association, the differences are generallly not great except in the case of the Leon-Plummer association. Variations in characteristics and exceptions for



KEY

SOIL ASSOCIATIONS

1 POMELLO - ST LUCIE ASSOCIATION
2 LAKELAND-ARREDONDO ASSOCIATION
3 BLANTON - LEON ASSOCIATION
4 LEON - PLUMMER ASSOCIATION
5 ONA - SCRANTON - LEON ASSOCIATION
6 RUSKIN - SUNNILAND - BRADENTON ASSOCIATION
7 RUTLEGE - FRESH WATER SWAMP - PLUMMER ASSOCIATION
8 BRIGHTON - TERRA CECIA ASSOCIATION
9 FRESH WATER SWAMP ASSOCIATION
10 SALT WATER SWAMPS AND MARSHES ASSOCIATION
11 MINE PITS AND DUMPS ASSOCIATION

SOURCE : U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE, 1969.

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GENERAL SOIL ASSOCIATIONS IN THE PLANNING AREA

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FIGURE I.4-10

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SOURCE: U.S. DEPARTMENT OF AGRICULTURE,
SOIL CONSERVATION SERVICE, 1969.

TABLE I.4-

DEGREE OF LIMITATIONS, RESTRICTIONS AND HAZARDS
HILLSBOROUGH COUNTY

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MAP SYMBOL	NAME OF ASSOCIATION WITH COMPONENT SOILS AND PERCENT OF EACH	DESCRIPTION	FLOOD HAZARD[1] (frequency/ duration)	WATER TABLE[2] SEASONALLY HIGH (depth and duration)	BUILD CONST FOUND FOR L BUILD
1	POMELLO-ST. LUCIE Pomello 31 St. Lucie 24 Leon 16 Others 29	Areas dominated by nearly level to gently sloping, nearly white, excessively to somewhat poorly drained, strongly acid, deep sands. The soils generally have a thin gray surface layer overlying a light gray sandy subsurface layer over fine white sand.	None to Infrequent - Brief	MOD Brief	Mode WT
2	LAKELAND-ARREDONDO Lakeland 41 Arredondo 23 Fresh Water Swamp 16 Others 20	Areas dominated by nearly level to gently sloping, well to somewhat excessively drained, slightly to very strongly acid, deep, brownish colored phosphatic and non-phosphatic sands. Major soil types have a dark gray to grayish brown fine sand surface layer. Beneath is yellowish brown to brownish-yellow fine sand.	None	MOD Deep Long	Sligh
3	BLANTON-LEON Blanton 24 Leon 23 Fresh Water Swamp 21 Others 32	Areas dominated by nearly level to gently sloping, moderately well drained, medium acid, grayish brown, deep sandy soils, interspersed with small to large areas of very strongly acid, more poorly drained, sandy soils, also unclassified soils in swamp.	None to Infrequent - Brief	Shallow Brief	Mode WT
4	LEON-PLUMMER Leon 61 Plummer 9 Others 30	Areas dominated by nearly level, very strongly acid, deep, somewhat poorly drained sands with an organic stained subsurface layer. The major soil type has very dark gray to gray fine sand surface layers. A leached, light gray fine sand subsurface with brown layers turning lighter in color as depth increases.	Infrequent Brief to V. Frequent Long	V. Shallor Brief to Long	Seve WT, F
5	ONA-SCRANTON-LEON Ona 30 Scranton 21 Leon 16 Others 33	Areas dominated by nearly level to gently sloping, somewhat poorly drained, strongly acid, deep sands on broad, low flatland.	Frequent Brief	V. Shallow Brief to Long	Seve WT, F
6	RUSKIN-SUNNILAND-BRADENTON Ruskin 40 Sunniland 30 Bradenton 15 Others 15	Areas dominated by nearly level, somewhat poorly drained, sandy soils with loamy to clayey subsoils.	Infrequent Brief	V. Shallow Brief	Seve WT
7	RUTLEGE-FRESH WATER SWAMP-PLUMMER Rutlege 25 Fresh Water Swamp 24 Plummer 10 Others 41	Areas dominated by nearly level, very poorly drained, deep, strongly acid to medium acid sands in low wetlands.	V. Frequent Long	V. Shallow Long	Seve FL, W
8	BRIGHTON-TERRA CELA Brighton 34 Terra Cela 30 Others 36	Areas dominated by nearly level, very poorly drained, shallow to moderately deep, acid to neutral organic soils in marshes and swamps.	V. Frequent V. Long	V. Shallow V. Long to Continuous	Very WT, F
9	FRESH WATER SWAMP	Areas dominated by nearly level, very poorly drained mineral and organic soils in stream bottoms and swamps. Soils in fresh water swamp are inaccessible due to wetness, dense vegetation and the soil materials vary within short distances.	V. Frequent V. Long	V. Shallow Continuous	Very FL, W
10	SALT WATER SWAMPS & MARSHES	Areas dominated by nearly level, very poorly drained saline soils lying adjacent to and affected by salt water tidal action.	V. Frequent V. Long	V. Shallow Continuous	Very WT, F
11	MINES, PITS AND DUMPS	Areas dominated by large open pebble phosphate mines and adjacent spoil mounds.	Variable	Variable	(Vari

1. FLOOD HAZARD

Classes:

Frequency		Duration	
None	Less often than once in 50 years	Extremely brief	Shorter than 2 days
Very infrequent	Once in 20 to 50 years	Very brief	2 to 7 days
Infrequent	Once if 5 to 20 years	Brief	7 days to 1 month
Frequent	Once in 1 to 5 years	Long	1 month to 6 months
Very frequent	More ofteh than once every year	Very long	Longer than 6 months

2. WATER TABLE

Classes:

Depth	
Deep	Deepe inche
Moderately deep	60 to
Moderately shallow	30 to
Shallow	59 to
Very shallow	0 to

TABLE I.4-2
DEGREE OF LIMITATIONS, RESTRICTIONS AND HAZARDS FOR SELECTED USES BY SOIL ASS
HILLSBOROUGH COUNTY, FLORIDA

produced from
t available copy.

DESCRIPTION	FLOOD HAZARD[1]/ (frequency/ duration)	WATER TABLE[2]/ SEASONALLY HIGH (depth and duration)	BUILDING CONSTRUCTION FOUNDATIONS FOR LOW BUILDINGS	SEWAGE LAGOONS	SEPTIC TANK FILTER FIELDS AND RAPID INFILTRATION (perculation) Land Treatment	Su
dominated by nearly level to gently ing, nearly white, excessively to hat poorly drained, strongly acid, sands. The soils generally have a gray surface layer overlying a gray sandy subsurface layer over white sand.	None to Infrequent - Brief	MOD Brief	Moderate WT	Severe Perm (Excessive)	Moderate[3]/ WT, Perm (Excessive)	
dominated by nearly level to gently ing, well to somewhat excessively ed, slightly to very strongly acid, brownish colored phosphatic and hosphatic sands. Major soil types a dark gray to grayish brown fine surface layer. Beneath is yellowish to brownish-yellow fine sand.	None	MOD Deep Long	Slight	Severe Perm (Excessive)	Slight[3]/	
dominated by nearly level to gently ing, moderately well drained, medium grayish brown, deep sandy soils, rspersed with small to large areas of strongly acid, more poorly drained, soils, also unclassified soils in .	None to Infrequent - Brief	Shallow Brief	Moderate WT	Severe Perm (Excessive) WT	Moderate[3]/ WT, FL	
dominated by nearly level, very gly acid, deep, somewhat poorly ed sands with an organic stained rface layer. The major soil type ery dark gray to gray fine sand ce layers. A leached, light gray sand subsurface with brown layers ng lighter in color as depth increases.	Infrequent Brief to V. Frequent Long	V. Shallor Brief to Long	Severe WT, FL	Severe WT	Severe WT, FL	
dominated by nearly level to gently ing, somewhat poorly drained, strongly , deep sands on broad, low flatland.	Frequent Brief	V. Shallow Brief to Long	Severe WT, FL	Severe WT	Severe WT, FL	
dominated by nearly level, somewhat y drained, sandy soils with loamy to y subsoils.	Infrequent Brief	V. Shallow Brief	Severe WT	Severe Perm	Severe WT	
dominated by nearly level, very y drained, deep, strongly acid to acid sands in low wetlands.	V. Frequent Long	V. Shallow Long	Severe FL, WT	Severe FL, Wt, Org	Severe WT, FL	
dominated by nearly level, very y drained, shallow to moderately , acid to neutral organic soils in es and swamps.	V. Frequent V. Long	V. Shallow V. Long to Continuous	Very Severe WT, FL, PBV	Very Severe FL, Org	Very Severe WT, FL	
dominated by nearly level, very y drained mineral and organic soils tream bottoms and swamps. Soils in water swamp are inaccessible due tness, dense vegetation and the materials vary within short distances.	V. Frequent V. Long	V. Shallow Continuous	Very Severe FL, WT	Vere Severe FL, Org	Very Severe FL, WT	
dominated by nearly level, very y drained saline soils lying adjacent d affected by salt water tidal action.	V. Frequent V. Long	V. Shallow Continuous	Very Severe WT, FL, PBV	Very Severe FL, Org	Very Severe FL	
dominated by large open pebble hate mines and adjacent spoil mounds.	Variable	Variable	(Variable)	(Variable)	(Variable)	

2. WATER TABLE

Classes:

	Duration	
years	Extremely brief	Shorter than 2 days
	Very brief	2 to 7 days
	Brief	7 days to 1 month
	Long	1 month to 6 months
year	Very long	Longer than 6 months

Depth		Duration	
Deep	Deeper than 120 inches	Very brief	Shorter than 1
Moderately deep	60 to 120 inches	Brief	1 to 2 months p
Moderately shallow	30 to 60 inches	Long	2 to 6 months p
Shallow	59 to 30 inches	Very long	6 to 12 months
Very shallow	0 to 15 inches	Continuous	More than 12 mo

TABLE I.4-2
AND HAZARDS FOR SELECTED USES BY SOIL ASSOCIATIONS
OUGH COUNTY, FLORIDA

TABLE[3] LLY HIGH and m)	BUILDING CONSTRUCTION FOUNDATIONS FOR LOW BUILDINGS	SEWAGE LAGOONS	SEPTIC TANK FILTER FIELDS AND RAPID INFILTRATION (perculation) Land Treatment	SUITABILITY FOR SPETIC TANK WITH HEALTH DEPT[4] CRITERIA CONSIDERED			SUITABILITY FOR SLOW RATE (IRRIGATION) LAND TREATMENT		
				Suitable	Questionable	Unsuitable	Suitable	Questionable	Unsuitable
	Moderate WT	Severe Perm (Excessive)	Moderate[3] WT, Perm (Excessive)	X	X WT FL		X LOW AWC		
	Slight	Severe Perm (Excessive)	Slight[3]	X			X LOW AWC		
	Moderate WT	Severe Perm (Excessive) WT	Moderate[3] WT, FL		X WT	X	X LOW AWC		
Long	Severe WT, FL	Severe WT	Severe WT, FL			X	X LOW AWC	X WT FL	
ong	Severe WT, FL	Severe WT	Severe WT, FL			X		X WT FL	
	Severe WT	Severe Perm	Severe WT			X			X WT MARL PERM
	Severe FL, WT	Severe FL, Wt, Org	Severe WT, FL			X			X WT FL
	Very Severe WT, FL, PBV	Very Severe FL, Org	Very Severe WT, FL			X WT FL Muck			X WT FL
	Very Severe FL, WT	Vere Severe FL, Org	Very Severe FL, WT			X WT FL Soil			X WT FL
	Very Severe WT, FL, PBV	Very Severe FL, Org	Very Severe FL			X WT FL Soil			X WT FL
	(Variable)	(Variable)	(Variable)		X Soil			(Variable)	

	Duration	
Deeper than 120 inches	Very brief	Shorter than 1 month per year
60 to 120 inches	Brief	1 to 2 months per year
30 to 60 inches	Long	2 to 6 months per year
59 to 30 inches	Very long	6 to 12 months per year
0 to 15 inches	Continuous	More than 12 months

3. SEPTIC TANK SEWER SYSTEMS FUNCTION WELL IN THESE SOILS; HOWEVER, POLLUTION OF GROUND WATER SUPPLIES IS A HAZARD.

4. SOURCE HILLSBOROUGH PLANNING COMISSION

ABREVIATIONS:

WT	WATER TABLE
FL	FLOOD HAZARD
AWC	AVAILABLE WATER CAPACITY
PBV	PRESUMPTIVE BEARING VALVE
ORG	ORGANIC
PERM	PERMEABILITY

3P

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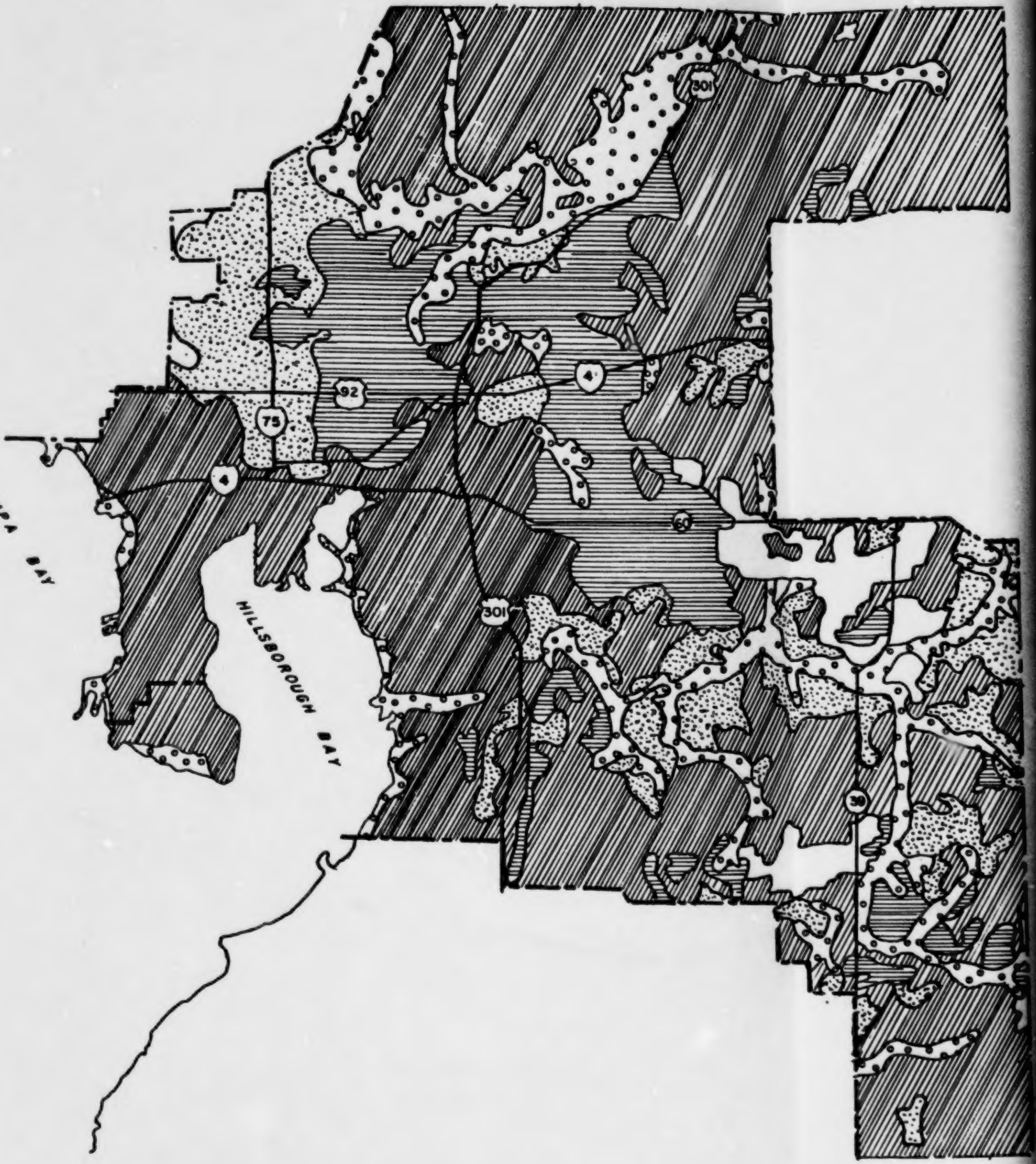
suitability exist to some degree within all of the associations, thus the detailed SCS soil survey must be consulted for any particular site.

Soils with few or no limitations for building construction and sanitation, such as the Lakeland-Arredondo associations, can usually be modified for these land uses with little difficulty. Soils with moderate limitations, such as the Blanton-Leon association and the Pomello-St. Lucie association, usually require more modification but are generally not uneconomical to modify. Severly limited soils, such as generally found with the Leon-Plummer association and other soil associations of Hillsborough County, require extensive and costly modifications to make these soils conform to the building construction and sanitation requirements. Very severely limited soils, such as the Brighton-Terra Ceia association and soils associated with swamps and estuaries, must often be replaced with a more suitable soil type in order to permit development (SCS, 1969; Hillsborough County Planning Commission, 1974).

The general suitability of various soil associations for building construction and sanitary purposes (such as septic tank filter fields and percolation-infiltration) is presented in Figure I.4-11. As illustrated in Figure I.4-11, only limited portions of the Planning Area are suitable for septic systems and other similar wastewater disposal methods. Soils in the eastern portions of the Planning Area and in an area which extends from just north of Thonotosassa southeasterly through Valrico and Brandon to a point just east of Bloomingdale are generally considered suitable for septic systems. However, as previously described, karst conditions and high permeability soils may restrict the use of septic tanks in the Brandon area. Other soils suitable for septic systems are scattered throughout the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CENTRAL HILLSBOROUGH COUNTY - TAMPA
201 FACILITY PLAN
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EPA No. C120634010

SOURCE : U.S. DEPARTMENT OF AGRICULTURE SOIL
SERVICE, 1969 AND HILLSBOROUGH COUN
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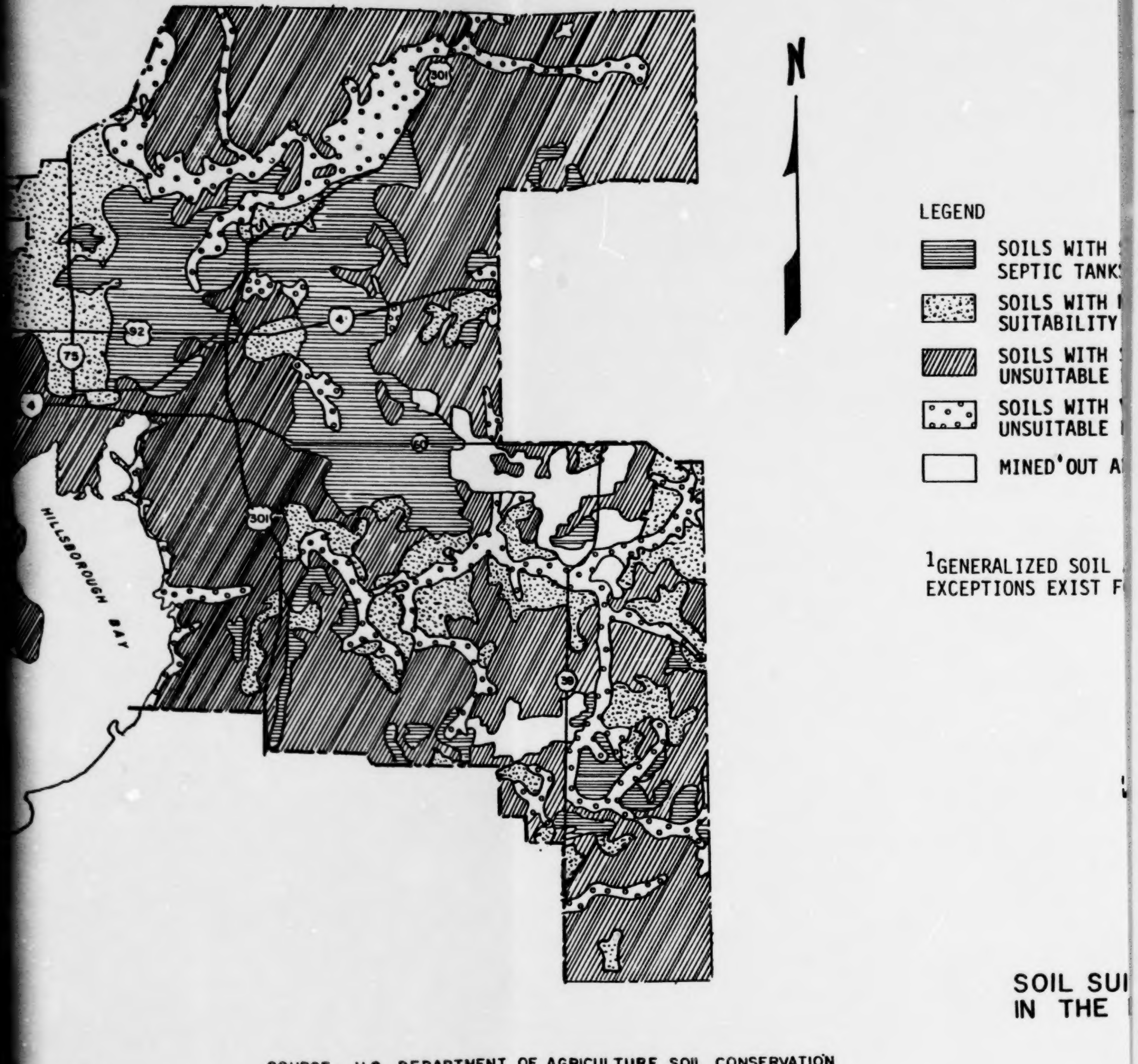
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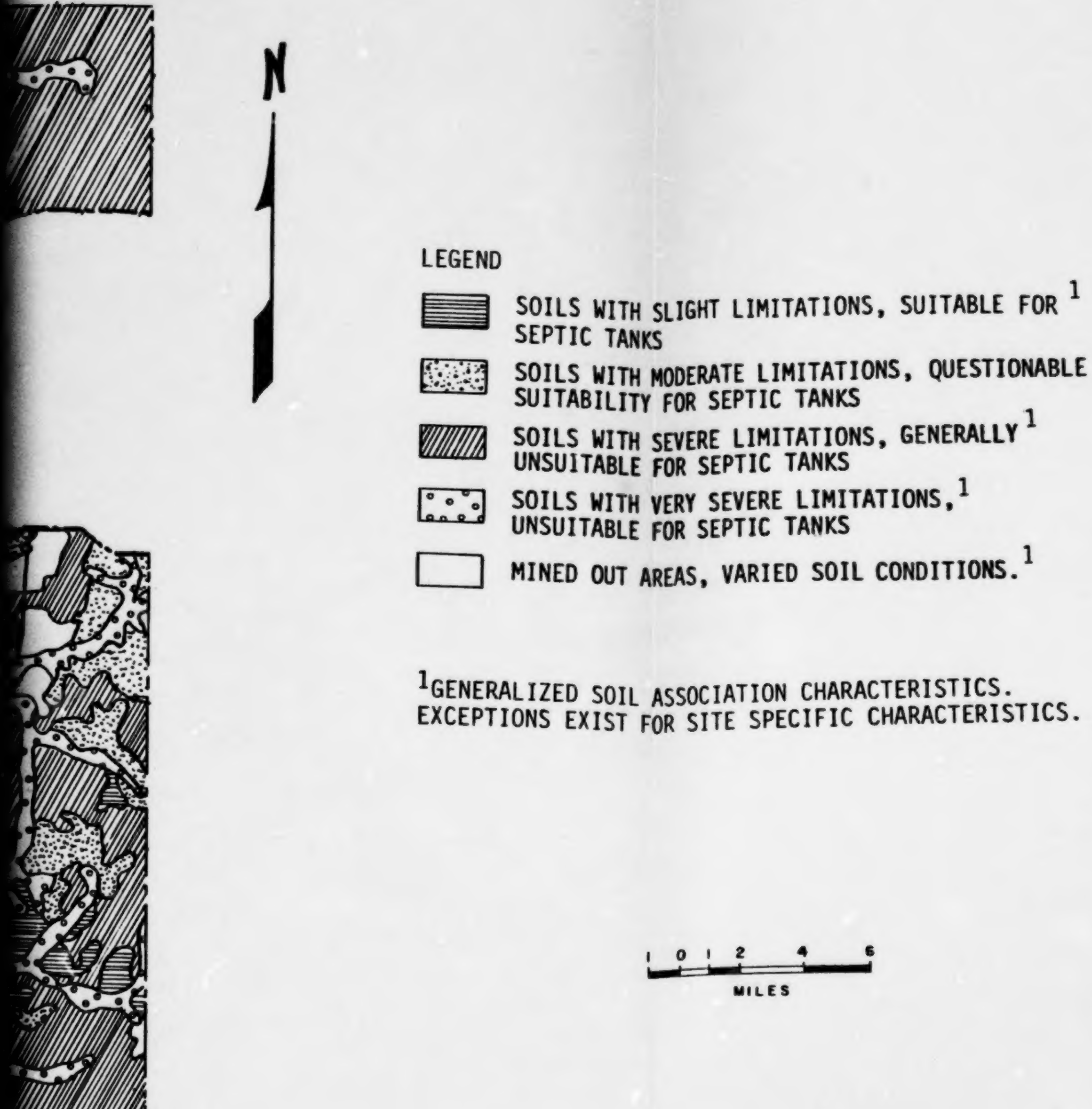
SOURCE : U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE, 1969 AND HILLSBOROUGH COUNTY PLANNING COMMISSION, 1974



LEGEND

- ▤ SOILS WITH SLIGHT LIMITATIONS, SUITABLE FOR SEPTIC TANKS[1]
- ░ SOILS WITH MODERATE LIMITATIONS, QUESTIONABLE SUITABILITY FOR SEPTIC TANKS
- ▨ SOILS WITH SEVERE LIMITATIONS, GENERALLY[1] UNSUITABLE FOR SEPTIC TANKS
- ⁘ SOILS WITH VERY SEVERE LIMITATIONS,[1] UNSUITABLE FOR SEPTIC TANKS
- ☐ MINED OUT AREAS, VARIED SOIL CONDITIONS.[1]

[1] GENERALIZED SOIL ASSOCIATION CHARACTERISTICS. EXCEPTIONS EXIST FOR SITE SPECIFIC CHARACTERISTICS.

SOIL SUITABILITY FOR SEPTIC TANKS
IN THE PLANNING AREA

LTURE SOIL CONSERVATION
OUGH COUNTY PLANNING

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FIGURE I.4-11

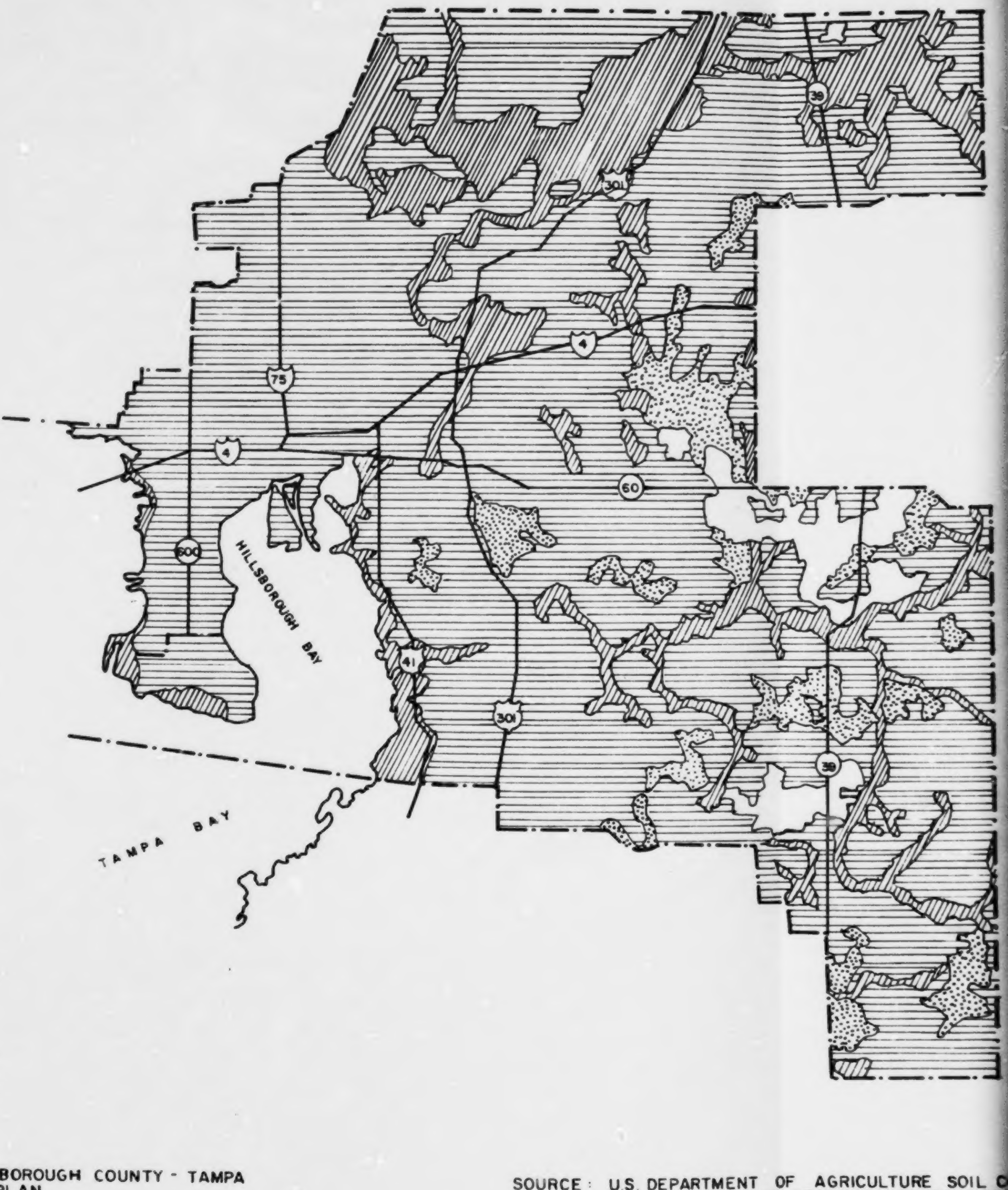
southeastern portions of the Planning Area. Only those soils with no flood hazard, as shown on Table I.4-2, are suitable for septic systems.

The largest single area containing soils with moderate limitations and of questionable suitability for septic system use extend north-south in a band three to five-miles wide northward from Lutz and the Hillsborough/Pasco County line southward to the Ybor City area. Similar conditions are found scattered throughout the southeastern portion of the Planning Area as indicated in Figure I.4-11.

Elsewhere in the county, soils exist with severe to very severe limitations. These are generally unsuitable for use in septic systems. Areas which are especially unsuited occur along the coast and in the flood-plains of the upper reaches of the Hillsborough and Alafia Rivers.

Soil suitability for sewage lagoons is severely to very severely limited for all soil associations in the Planning Area. Those soils not limited by water table or flood hazard are limited by permeability (Table I.4-2).

Many of the county's soils are generally suitable for slow rate (irrigation) land treatment methods. Unsuitable soils include those subject to very frequent flooding, those with a very shallow water table and fine, poorly structured soils. Areas of deep sands may also be unsuitable since problems with ground-water contamination may occur (personal communication SCS, J.W. Miller, 1979). However, soils with low available water capacity require more frequent irrigation which may make them attractive as land treatment sites. Soils suitability for slow rate land treatment is shown in Table I.4-2 and Figure I.4-12. It should be noted that the Leon-Plummer association is shown as suitable, even though Plummer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ENVIRONMENTAL REPORT
EPA No. C120634010

SOURCE: U.S. DEPARTMENT OF AGRICULTURE SOIL C
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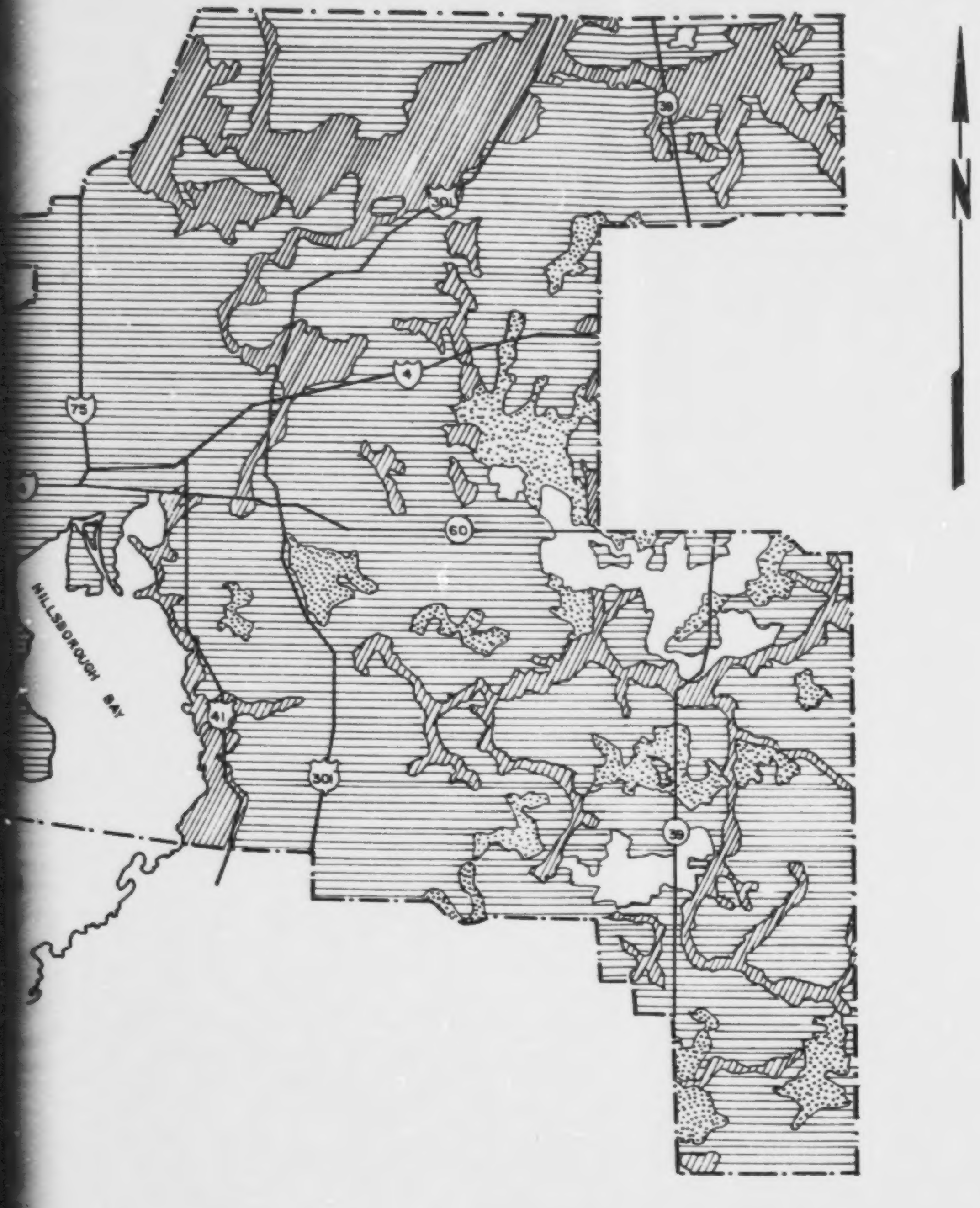
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LEGEND

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[1] GENERALIZED SOIL
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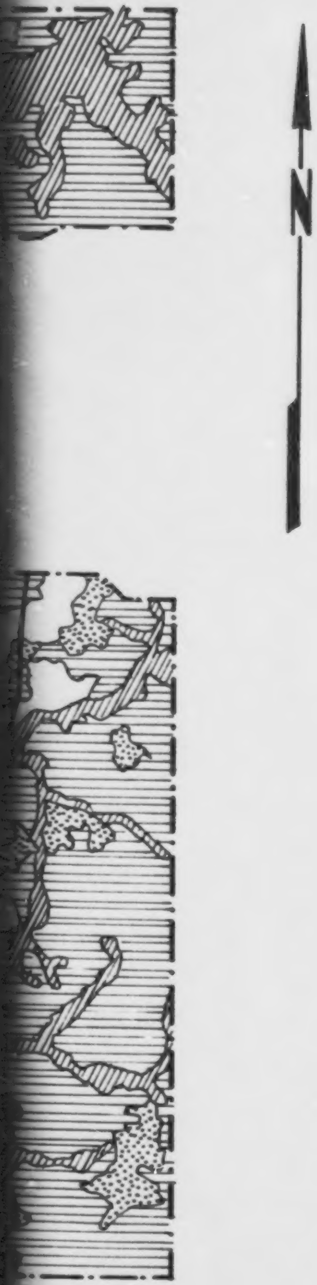
SOURCE: U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION
SERVICE, 1969 AND PERSONAL COMMUNICATION,
J.W. MILLER (SCS), 1979



LEGEND

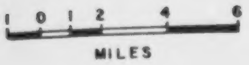
▤ SOILS WITH SLIGHT LIMITATIONS, SUITABLE[1]

░ SOILS WITH MODERATE LIMITATIONS, QUESTIONABLE SUITABILITY[1]

▨ SOILS WITH SEVERE LIMITATIONS, GENERALLY UNSUITABLE[1]

☐ MINED OUT AREAS, VARIED SOIL CONDITIONS[1]

[1] GENERALIZED SOIL ASSOCIATION CHARACTERISTICS. EXCEPTIONS EXIST FOR SITE SPECIFIC CHARACTERISTICS.



SOIL SUITABILITY FOR SLOW RATE LAND TREATMENT IN THE PLANNING AREA

LTURE SOIL CONSERVATION
L COMMUNICATION,

DAMES & MOORE

FIGURE I.4-12

soils are subject to very frequent flooding, sincs Leon soils (61 percent of the association are suited for slow rate land treatment.

I.4.2 Tesrrestrial Ecology

a. Vegetation: Mature ecosystems of sufficient size to support communities free from outside competitive influences are a fast disappearing aspect of vegetational coverage within Hillsborough County. Many areas are either urbanized, developed for agricultural use, or actively being cleared for industrial purposes. The major terrestrial and wetland plant communities occurring in Hillsborough County include the following:

1. An intertidal zone comprised of mangroves and salt marshes.
2. A riverine forest comprised of both cypress and hardwood forests; the latter is subdivided into bayheads, mixed hardwoods and mesic hammock.
3. Cypress domes
4. Freshwater marshes
5. Pine flatwoods
6. Pine-scrub oak sandhills comprised of longleaf pine-scrub oak and sand pine-scrub oak associations.
7. Old field

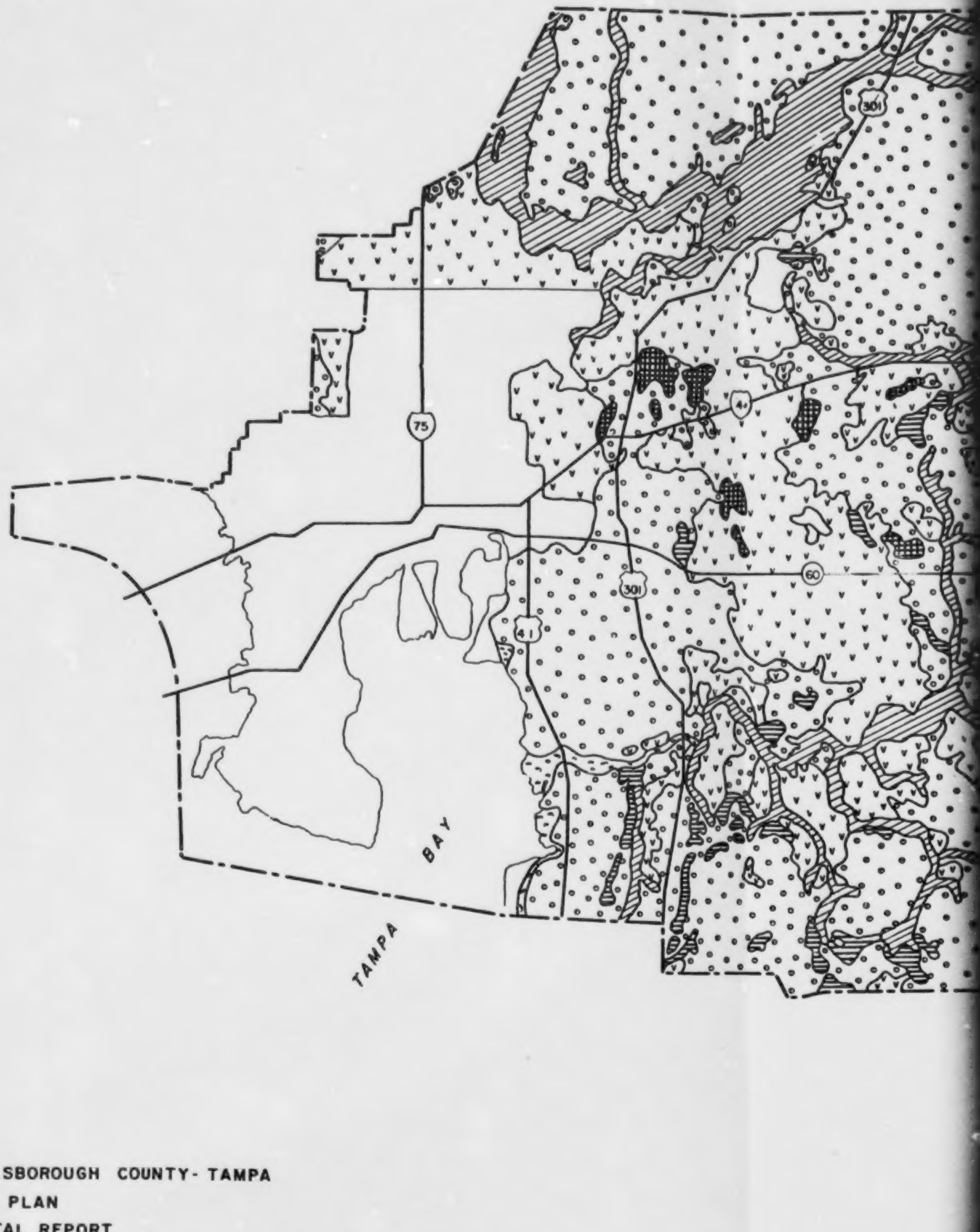
These communities are distinguished from one another according to their species composition. Each community contains certain plant species that occur in greater abundance than other species. Local differences in species composition and community distribution result primarily from variations in edaphic (of or relating to the sol) conditions and/or water availability.

The first four of the aforementioned plant communities are described under wetlands in Section I.5.2. The riverine forest, although composed of both wetland and terrestrial habitats, is also included within the wetland section. This is due to the close interrelation between the low mesic forest and the swamp forest; influences on one type can also be expected to affect the other. Figure I.4-13 illustrates the ecological habitats, inclusive of wetland areas and Figure I.4-14 illustrates only true wetlands, i.e., mangroves, saltwater marsh, freshwater marsh, and swamps. The latter are discussed in Section I.5.2.

Pine Flatwoods - The pine flatwoods vegetation type, which probably forms the most extensive vegetation type in Hillsborough County, is an open forest of pine, cabbage palm, saw palmetto, and scattered hardwood shrubs and trees. The herbaceous ground cover is usually dominated by grasses. These flatwoods occur on broad level plains slightly higher in elevation than cypress dome communities or freshwater marshes and swamps. The wetland communities are often interspersed within the pine flatwoods and create an "edge effect" that produces rich floral communities and valuable wildlife habitat (Cowel, et al., 1974).

The soils in pine flatwoods are characterized by extremes in internal and surface drainage. During summer rains, flatwoods tend to flood due to poor drainage characteristics that prohibit downward percolation while during winter and spring months, then evaporation is highest, they tend to dry out. Plants of these soils are primarily xerophytic since species must be capable of coping with the alteration between actual drought and physiological drought during flooding (Cowell, et al., 1974).

The woody vegetation of the flatwoods is comprised principally of slash or longleaf pine. The longleaf pine dominates the drier sites



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TAMPA BAY

CENTRAL HILLSBOROUGH COUNTY- TAMPA
201 FACILITY PLAN
ENVIRONMENTAL REPORT
EPA No. C120634010

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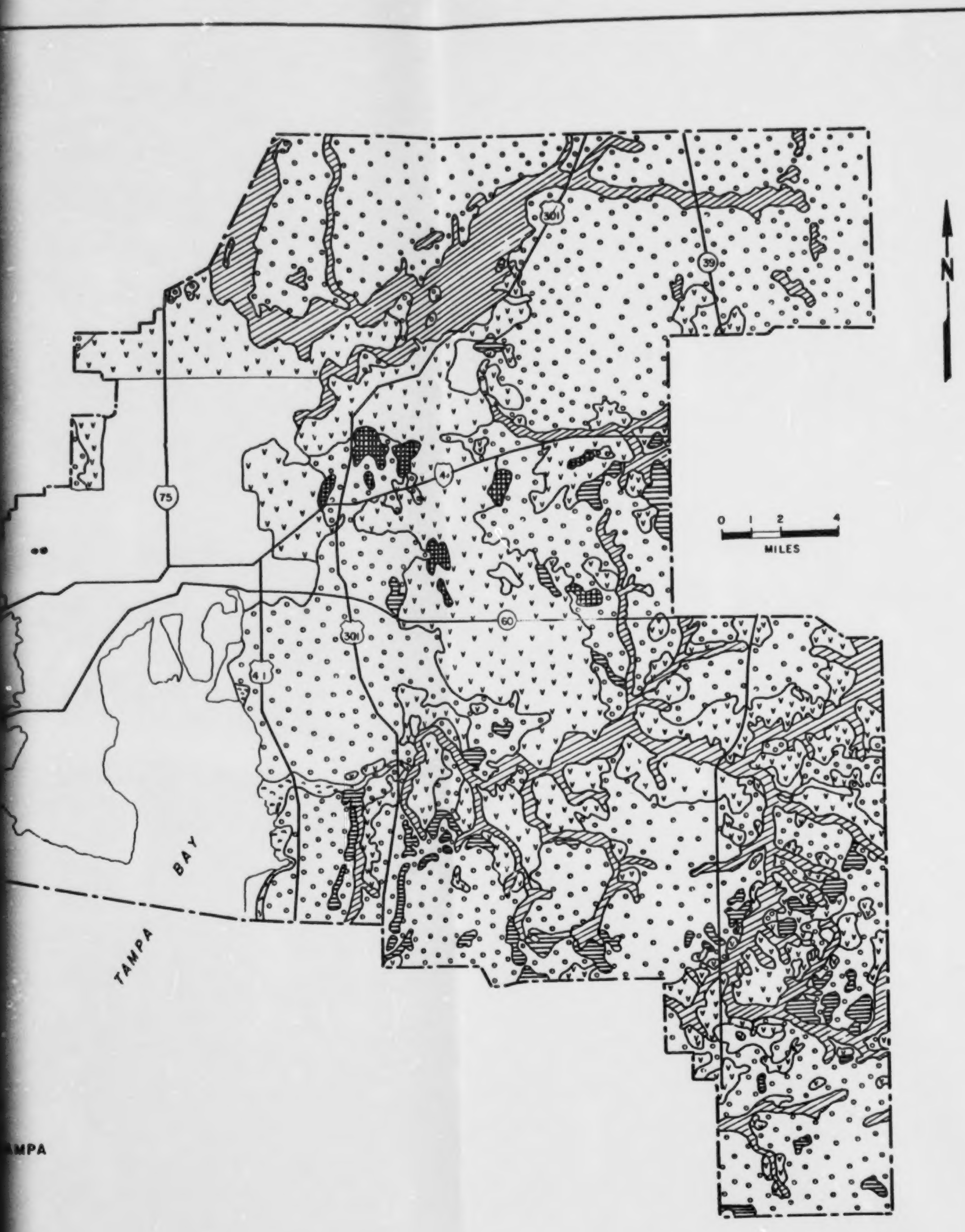
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TAMPA BAY
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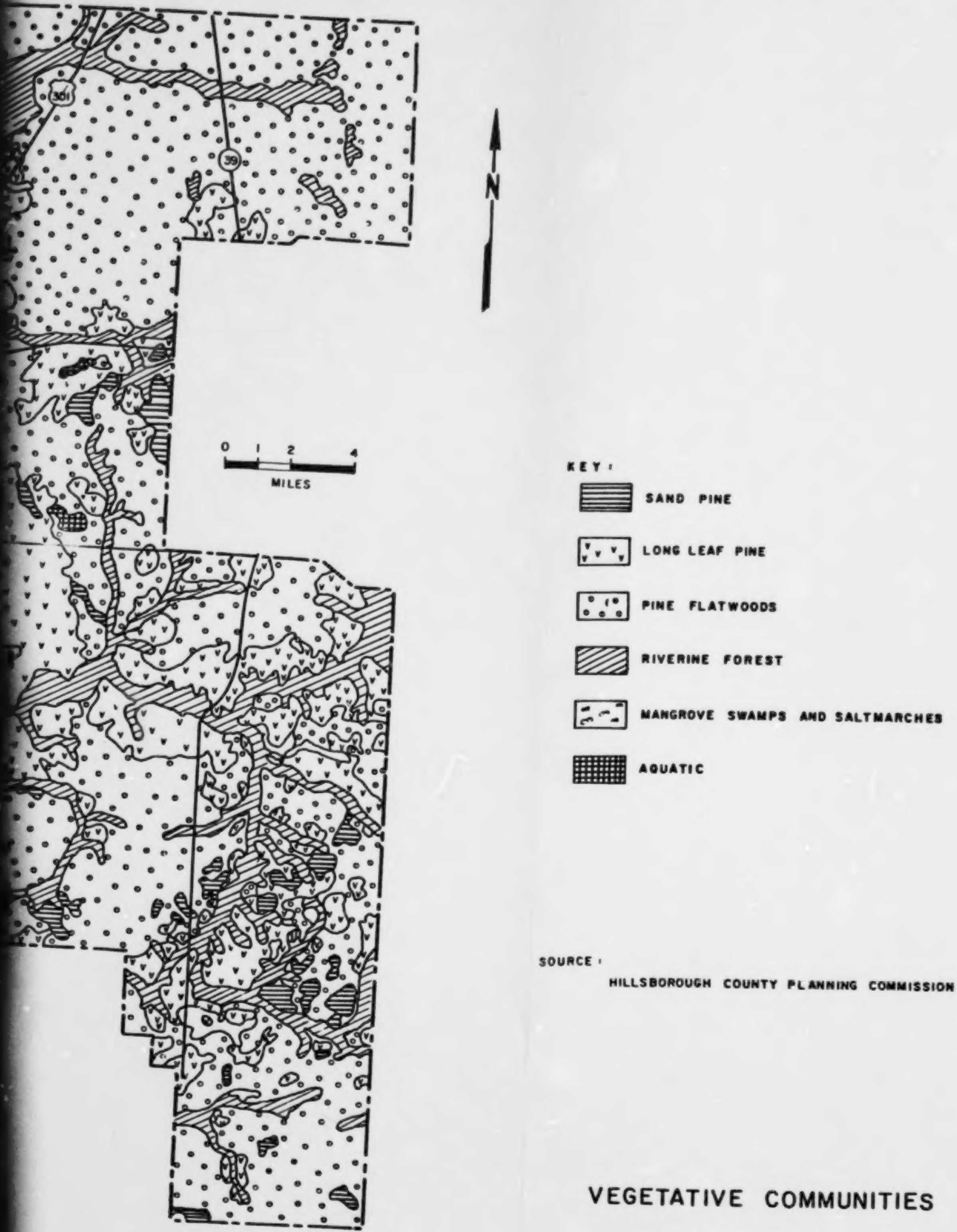
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KEY:
SAND PINE
LONG LEAF PINE
PINE FLATWOODS
RIVERINE FOREST
MANGROVE SWAMPS AND SALTMARCHES
AQUATIC

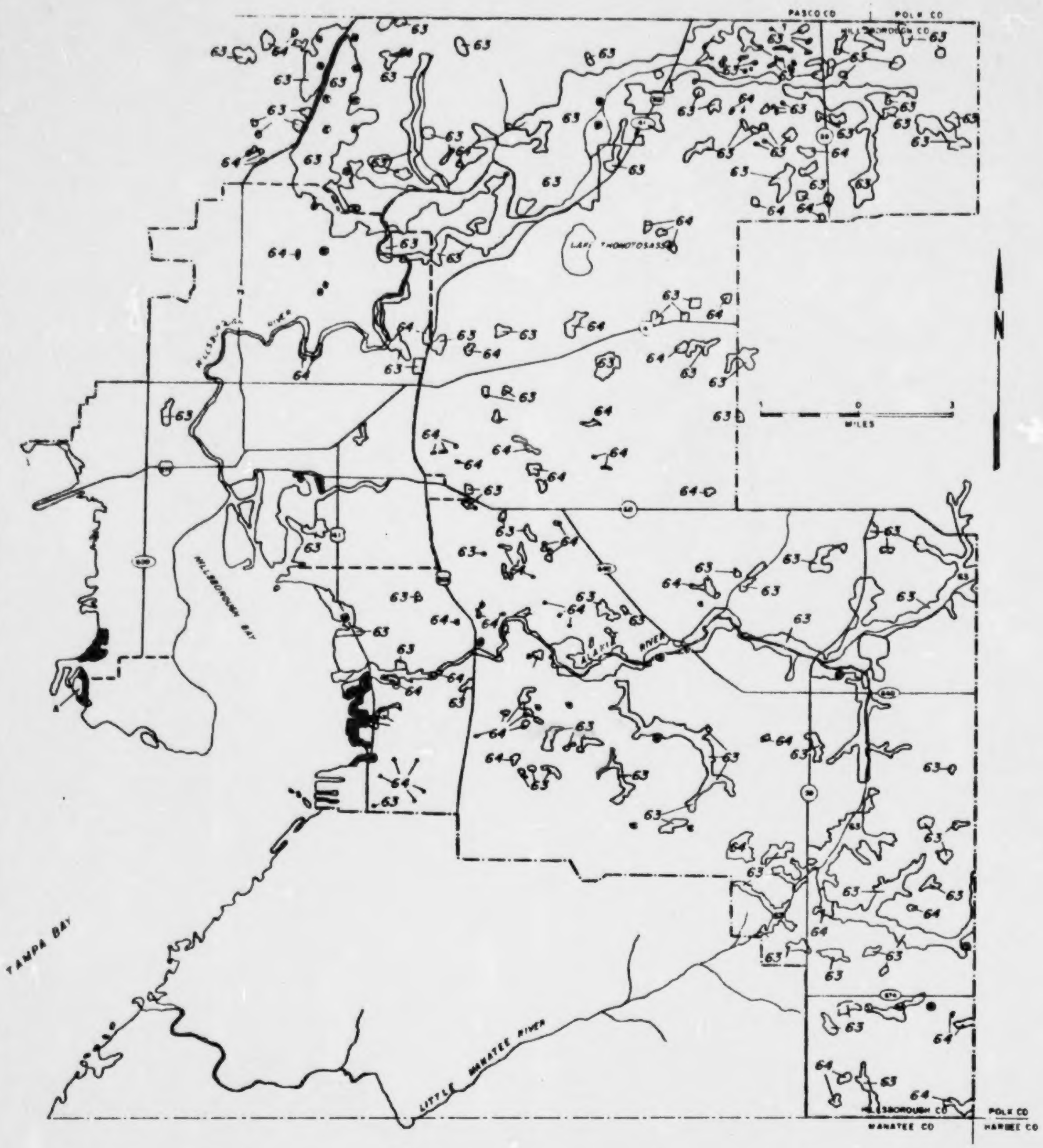
SOURCE:
HILLSBOROUGH COUNTY PLANNING COMMISSION

VEGETATIVE COMMUNITIES

I-85

DAMES & MOORE

FIGURE I.4-13


PASCO CO
POLK CO
HILLSBOROUGH CO
LAKE THONOTOSASSA
HILLSBOROUGH RIVER
HILLSBOROUGH BAY
ALAFIA RIVER
TAMPA BAY
LITTLE MANATEE RIVER
MANATEE CO
HARDEE CO
MILES
N
63
64

KEY:

- ● SALT WATER FORESTED WETLAND (MANGROVE)
- A SALT WATER MARSH
- 63 FRESH WATER FORESTED WETLAND (HARDWOOD, MIXED CYPRESS SWAMPS
- 64 FRESH WATER MARSH
- Ⓢ PROTECTED SPECIES

SOURCE: DAMES & MOORE AND SWFWMD, 1979
WUNDERLIN, 1979 AND BOARD OF COUNTY
COMMISSIONERS, 1978

*NOTE TO BE USED IN CONJUCTION WITH VEGETATIVE COMMUNITIES MAP

CENTRAL HILLSBOROUGH COUNTY-TAMPA
201 FACILITY PLAN
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WETLANDS AREAS*

DAMES & MOORE

FIGURE I.4-14

and forms a transition zone that links the pine-oak sand hills with the continuous, wetter flatwoods. The longleaf pine flatwoods may be regarded as sub-climax. The longer leaf length of the longleaf pine protects young buds from fire damage, allowing this pine to inhabit drier areas (Monk, 1968). Observations within the Lower Hillsborough Flood Detention Area indicate that disturbances such as cutting are responsible for the replacement of longleaf pine by slash pine as the dominant tree in many areas (Cowel, et al., 1974).

The most common understory shrum is saw palmetto. However, a constant invasion of the understory layer by hardwood species provides a relatively high species diversity. Common herbaceous plants of the forest floor, other than grasses, include pipeworts, day flower, yellow-eyed grass, composites and sedges. Greenbriar is a vine also commonly found in these flatwoods habitats.

Succession within the flatwoods is influenced by both fire and artificial drainage (Edmisten, 1963). In the absence of frequent fire, live oak hammocks dominate the drier sites while mixed hardwoods or bayheads domionate wetter areas. Generally, where fire is controlled or artificial drainage influences flatwoods succession, hardwoods become the dominant plant species. Improved moisture balance, root aeration, and increased microbial activity benefit both pines and hardwoods, but only the hardwoods are able to continue to regenerate in a closed canopy cover. Plant species that invade the flatwoods are dependent on chance proximity, water availability and chemical composition of the soil. Possible hardwood invaders include live oak, laurel oak, southern magnolia, turkey oak, bluejack oak. sweet gum, persimmon, wax myrtle, myrtle oak, Chapman's oak, black cherry, sparkley berry, winged sumac and hickory.

Pine-Scrub OaK Sandhills - The longleaf pine-scrub oak association forms the primary sandhills vegetation type within Hillsborough County. Although not a common vegetation type in Hillsborough County, the drier pine flatwoods (pine sandhills) areas in west central Florida are known to exhibit sites suitable for development of the sand pine-scrub oak association (Lakela, Olga, and Long, 1970). These associations occupy deep, upland soils with low fertility that are characteristically xeric, sloping and acid. Fire and sand pine are inseparable in areas having large aggregations of this particular species of pine since fire is required for cone opening and reproduction.

Succession within the longleaf pine-scrub oak association proceeds toward mixed hardwoods on limestone-derived soils and toward live oak hammock on the more acid sandy soils (Pessin, 1933). However, these successional varients are only evident in areas where the frequency and intensity of fire has been altered for a period of years. With the elimination of fire, oaks dominate the canopy, shading the soil surface and prohibiting further establishment of longleaf pine seedlings. The closed canopy created by the oaks results in a mesic microclimate and buildup of forest floor litter that provides favorable conditions for the continued regeneration of oaks. In the fire maintained, pine-turkey oak community, fire tolerant longleaf pine seedlings are able to compete and become established. The oaks, on the other hand, are less fire tolerant and are frequently eliminated by fire. If fires are not controlled the present longleaf pine scrub oak association can be expected to prevail (Pessin, 1933). As development continues to encroach upon the rural areas of Hillsborough County, the implementation of more stringent fire control measures that reduce the frequency of fires may eventually further the successional advance of oaks. Additionally, surveys within the Lower Hillsborough Flood Detention Area (Cowell, et al., 1974) indicate that disturbances such as grazing have altered the vegetative compositions of some of the remaining sandhill communities.

The most common oaks of the pine-scrub oak association are turkey oak, live oak, sand post oak and occasional bluejack oak. Other shrubs and trees include occasional slash pine, persimmon and hawthorn. The ground cover consists in large part of wiregrass, broomsedge, milkwort, milkweeds, tread-softly and many other herbaceous species (Cowell, et al., 1974).

Under proper wildlife management, the sandhills of Florida have a potential for providng wildlife, recreational and economic uses. Understory vegetation associated with the dominant sand pine vegetation presently supports small populations of many wildlife species and are popular areas for hunting.

Old Field - The successional trends of old fields are strongly influenced by external influences. An old field is a seral stage of either primary or secondary succession. In primary succession, old fields represent drained land surfaces that were once water bodies which, through natural processes of aging and deposition of organic material, became a marsh, a prairie, and eventually an old field. More commonly, secondary succession occurs, in which an abandoned agricultural field, pasture, or barrenland will be invaded by forb species to become an old field. Community succession does not necessarily stop here, and, in the absence of fire, shrubby hardwood species invade. The eventual result is a mixed deciduous, climax forest. However, under more exeric edaphic conditions, fire is relatively common, allowing the more fire resistant slash or longleaf pines to invade.

Common components of old field communities include broomsedge, ragweed, horseweed, pigweed and dog fennel. This vegetation complex comprises the major open-field vegetation type of Hillsborough County.

Protected Flora - Most of the threatened or endangered plant species occurring in Hillsborough County are inconspicuous, and the lack of sightings does not necessarily indicate their absence within the county. Furthermore, identification of annuals or non-evergreen perennials (such as Curtis milkweed) is not possible unless leaves and especially flowering parts are fully developed. Table I.4-3 provides pertinent information, including habitat requirements, concerning protected plants that have been collected in Hillsborough County and locations of these species are shown in Figure I.4-13. Habitat types in which most of these species occur should be considered sensitive. Sandhills, riverine forests, coastal strands (intertidal habitats), cypress domes and marshes should be considered as ecologically valuable and sensitive habitats. Extensive development in these areas will prove deleterious to the preservation of these species and reduce existing acreages of important wildlife habitat.

b. Animals: Amphibians and Reptiles - Portions of the Planning Area provide good habitat for many species of amphibians and reptiles. These habitats are disappearing due to development and/or land use modification. The herpetofauna (amphibians and reptiles) of Florida are well documented in the works of Carr and Goin (1955) and species lists are available for portions of Hillsborough County. A total of 179 amphibian and reptile species occur in Florida including 28 species of frogs and toads, 29 species of salamanders, 35 species of turtles, 25 species of

TABLE I.4-3

PROTECTED PLANTS OCCURRING IN HILLSBOROUGH COUNTY, FLORIDA

Species	Common Name	Florida List[1]	Federal List[2]	Status	Habitat
Asciepias curtisii	Curtis Milkweek	X		T	White sand scrub area with *Pinus clausa*, *Quercus geminata*, *Q. myrtifolla*, *Ceratiola ericoides*, and often *Ximenia americana*. St. Lucie fine sand.
Aspienium aurltum	Auricied Spirrneoty	X		E	Mesic hammocks dominated by hardwoods (*Quercus virginiana*, *Acer rubrum*) with an understory of *Mahnoiia grandiflora*, *Sabal palmetto*, *Ulmus americana*, etc. Usually found growing on Quercus Virginiana especially on old or fallen logs.
Caiilrhoe papaver	Poppy Mallow	X		T	Lawn-(usually in oak-hickory woods). Probably introduced as weed and now extinct.
Centrosema arenicola	Butterfly pea		X	E	Well drained sandy soils mixed with low shrubs (*Gaylussacia myrica*, etc.) and scrub oaks. Often found in white sand scrub and in oak-hickory woods. Occasionally found in overgrown ditches along highways and on sandy terraces of rivers.
Chrysopsis floridana	Golden Aster	X		E	White sand scrub and *Pinus clausa*, *Quercus geminata* as dominants. Associated with *Serenoa repens*, *Vaccinium* spp., *Lyonia* spp., *Palafoxia feayl*, etc. St. Lucie fine sand.

TABLE I.4-3 (Continued)

Species	Common Name	Florida List	Federal List	Status	Habitat
Ernodea littoralis	Ernodea	X		T	Coastal strand, growing in sand dunes on gulf side of key. *Sabal palmetto* dominant. Associated with *Cocoloba uvifera*, *Rapanea guianensis*, *Chiococca Alba*, and *Surlana maritima*. Probably Palm Beach sand.
Helianthus debilis	Sunflower		X	T	On beach strand behind surf zone on keys and bay. Secondary vegetation with *Sabal palmetto*.
Hymenocallis latifolia	Spider lily		X	T	Wet areas in cypress swamps and along rivers. Occasional on shell middens on keys.
Lechea cernua	Pinweed		X	T	White sand scrub with *Pinus clausa*, *Ceratiola ericoides*, and scrub oaks. St. Lucie fine sand.
Lechea divaricata	Pinweed		X	T	Seasonally wet, grassy, open longleaf pineland with *Serenoa repens*, *Sabal palmetto*, and *Myrica cerifera*. Usually sandy soil in pine-oak woods. Leon fine sand or Pomello fine sand.
Ophioglossum palmatum	Hand fern	X		E	Epiphytic on *Sabal palmetto* in mesic hammocks, usually with live oak dominant. Peace River soils.
Peltandra sagittifolia	Spoonflower	X		R	Usually in soggy soil in rick mesic woods. Often in wet ditches bordering hammocks and cypress heads. Alluvial soils.

(Continued)

TABLE I.4-3 (Continued)

Species	Common Name	Florida List	Federal List	Status	Habitat
Physostegia leptophylla	Obedient plant		X	T	Floodplains and banks of rivers and seepage areas. Elms, cypress and other hardwoods dominant. Moist sandy peat at margin of cypress swamp.
Rhapidophyllum hystrix	Neddle palm	X	X	T	Rich mesic woods with *Quercus virginiana*, *Acer rubrum*, *Liquidambar styraciflua*, *Magnolia* spp., and *Sabal* spp. Often in flood plains of rivers and streams, just in back of OHW line. Alluvial soil.
Verbena tampensis	Verbena		X	E	Disturbed sand muck on the margins of and in *Sabal palmetto*-*Quercus virginiana* hammocks; sometimes in depressions in pine flatwoods or adjacent to mangroves.
Zamia pumila	Coontie	X	X	T	Usually pinewoods with turkey oak and saw palmetto in dry sand soil and occasionally on shell mounds and mesic hammocks.
Zephyranthes atamasco	Rainlily		X	T	Seasonally wet open grassy areas, roadside ditches, pastures, and pine flatwoods margins.

(Continued)

TABLE I.4-3 (Continued)

Species	Common Name	Florida List	Federal List	Status	Habitat
Zephyranthes simpsonii	Rainlily		F	T	Disturbed flatwoods with saw palmetto, slash pine as dominants. Often in moist roadside ditches.

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[1] Endangered, threatened, and rare plant taxa known to occur in Hillsborough County, Florida according to the Florida List (to be published in 1979 by the Florida Committee on Rare and Endangered Plants and Animals).

[2] Endangered and threatened plant taxa known to occur in Hillsborough County, Florida according to federal list (Endangered and Threatened Plants of the United States, Ayensu, E.S. and R.A., DeFilipps, Smithsonian Institute and World Wildlife Fund, Inc. 1978).

T = Threatened
E = Endangered
R = Rare

Source: Wunderlin, 1979

TABLE I.4-4

AMPHIBIANS AND REPTILES

Common Name	Preferred Habitat	Conservation Status/ Comments
American Alligator	All wetland types, rivers, lakes, ponds, marshes, canals.	Special Concern
Florida Snapping Turtle	Any freshwater or brackish water, permanent.	
Suwannee Cooter	Clear water springs.	Often in Gulf-Treatened
Peninsula Cooter	Lakes, sloughs, wet prairies canals.	
Florida Red-bellied Turtle	Streams, ponds, lakes, marshes, ditches and mangrove lines, creeks.	
Florida Chicken Turtle	Still water ponds, marshes and ditches.	Often on land
Gopher Tortoise	Sandy, well drained sandhill ridges.	Threatened
Stripped Mud Turtle	Deep drainage canals, sloughs, wet prairie and pasture.	Often forages on land
Florida Mud Turtle	Drainage ditches, marshes, sloughs and ponds.	
Ornate Diamondback Terrapin	Brackish marshes, embayments.	Often in mangroves
Stinkpot	Shallow clearwater lakes, ponds and river.	
Florida Box Turtle	Pine flatwoods and improved pastures.	Popular pet species ecologically significant
Florida Softshell	Canals, ponds, lakes and big springs.	One of the most conspicuous species popular food item, thus economically significant

(Continued)

TABLE I.4-4 (Continued)

Common Name	Preferred Habitat	Conservation Status/ Comments
Worm Lizard	Dry sandy ridges and sandhills.	Limbless, eyeless, scaled burrower ecologically significant
Green Anole	Cosmopolitan shrubs buildings.	Well adapted to urban settings, common ecologically significant
Cuban Brown Anole	Cosmopolitan shrubs buildings.	Introduced via shipping commerce
Six-lined Racerunner	Oldfield, river flood plains.	Only whiptail in eastern U.S.
Southeastern Five-lined Skink	Variety of habitats.	
Ground Skink	Woodlands floor common in yards as well.	Sideway movements
Slender Glass Lizard	Dry grasslands, old field.	Fragile tail as all glass lizards are
Island Glass Lizard	Coastal area and inland scrub pine regions.	Also on offshore islands
Eastern Glass Lizard	Wet prairie and pine flatwoods.	
Southern Fence Lizard	Sandy, well drained ridges, sandhills	Arboreal-ecologically significant
Florida Scrub Lizard	Sandy, well drained ridges, turkey oaksand pine sandhills.	Possibly existing in sandhills. Rare
Two-toed Amphiuma	Ditches, ponds, swamps, marshes.	Highly aquatic
Southern Dusky Salamander	Cypress ponds.	Prefers acidic waters
Florida Newt	Ponds, ditches and swamps.	Hyacinthis associated ecologically significant
Dwarf Salamander	Low wet swamps.	Ecologically significant

(Continued)

TABLE I.4-4 (Continued)

Common Name	Preferred Habitat	Conservation Status/ Comments
Peninsula Newt	Ponds, ditches and swamps.	Hyacinths associated ecologically significant
Slimy Salamander	Woodlands and ravines.	Skin glan secretions
Dwarf Siren	Marshes, ponds.	Partial to hyacinths
Eastern Lesser Siren	Weed choked canals and ponds.	
Greater Liren	Shallow water ditches and ponds.	
Southern Cricket Frog	Riverine floodplaines.	
Giant Toad	Cosmopolitan.	Introduced, significant ecologically
Oak Toad	Pinewoods, hammocks.	
Southern Toad	Sandy well drained old field.	Chiefly nocturnal
Greenhouse Frog	Gardens, hammocks and stream floodplains.	Introduced
Eastern Narrow-Mounted Toad	Varied.	Seeks moisture and shelter
Green Tree Frog	Swamps, lakes and residential yards.	
Pine Woods Treefrog	Pine flatwoods cypress swamps.	Arboreal
Barking Treefrog	Varied, shrubs.	Climber and burrower
Squirrel Treefrog	Varied, cosmopolitan.	
Little Grass Frog	Ponds, cypress bays.	Elfin frog
Florida Chorus Frog	Varied, ponds, ditches and flatwoods.	
Ornate Chorus Frog	Cypress ponds and wet prairie.	
Florida Gopher Frog	Coastal hammocks dry ridges.	Threatened. Most often associated with Gopher Tortoise

(Continued)

TABLE I.4-4 (Continued)

Common Name	Preferred Habitat	Conservation Status/ Comments
Bullfrog	Open water bodies lakes, ponds and marshes.	Economically significant
Pig Frog	Quiet fringes of marshes and lakes.	Economically significant
Southern Leopard Frog	Shallow freshwater areas, some brackish	
Eastern Spadefoot Toad	Sandy ridges croplands.	Ecologically significant
Eastern Cottonmouth	Swamps, lakes, rivers and moist pine flatwoods.	Poisonous viper
Scarlet Snake	Old field, agricultural croplands.	Preys on snake eggs
Southern Black Racer	Old field, flatwoods.	Climbs
Eastern Diamondback Rattle Snake	Palmetto flatwoods, dry pine flatwoods, and sandhills.	Poisonous
Mangrove Watersnake	Salt and brackish water; mangrove swamps.	
Southern Ringneck Snake	Floodplains, near creeks, lakes and ponds.	Chiefly nocturnal
Eastern Indigo Snake	Pine flatwoods, hammocks, and sandhills.	Often associated with Gopher Tortoise
Corn Snake	Pine flatwoods, old field, croplands.	Climbs well
Yellow Rate Snake	River swamps, oak hammocks, and old field.	Climbs high in cypress, common
Mud Snake	Swamps and marshes.	Burrowing, also swimmer
Eastern Hognose Snake	Sandy, well drained ridges and sandhills.	
Scarlet Kingsnake	Pine flatwoods.	Secretive, chiefly nocturnal

(Continued)

TABLE I.4-4 (Continued)

Common Name	Preferred Habitat	Conservation Status/ Comments
Striped Swamp Snake	Shallow water with dense vegetation canals and ponds.	Partial to hyacinths
Eastern Coachwhip	Varied, river floodplains to dry mudhills.	Prowls with head upright
Eastern Coral Snake	Varied, well drained to moist wetland boarders.	Venomous
Florida Green Water-Snake	Swamps, marshes, and quite lakes, and ponds.	Sometimes in brackish waters
Florida Watersnake	Shallow water habitats, swamps, and marshes.	Ecologically significant
Brown Watersnake	Clear, quiet waters.	Swimmer and tree climber
Rough Green Snake	Borders of lakes, ponds and in rural residences	"Vine" snake very thin and climbs
Florida Pine Snake	Dry sandy old field xeric hammocks.	Pocket gopher favorite food
Yellow-lipped Snake	Damp lowlands; borders of swamps.	
Southern Florida Swamp Snake	Ponds, canals and ditches.	Partial to hyacinths
Dusky Pygmy Rattlesnake	Pine flatwoods and lake fringes and marshes.	Ecologically significant, venomous
Florida Brown Snake	Bogs and marshes and upland hammocks.	Active following heavy rains
Florida Crowned Snake	Sandhills and hammocks.	Secretive, ecologically significant
Peninsula Ribbon Snake	Wetland areas.	Semi-aquatic
Eastern Garter Snake	Pine flatwoods, marshes, lawns and parks.	Common, well known
Florida Red Bellied Snake	Uplands	Uncommon, locally abundant

Source: Dames & Moore, 1975; Conant, 1975; and USEPA, 1978.

lizards, 60 species of snakes, 1 crocodile and 1 alligator. Over eighty of these species are documented as occurring in the Planning Area and are listed in Table I.4-4.

Amphibians and reptiles may be expected in either the upland or bottomland habitats in this area. Upland habitats include pine flatwoods, pine-scrub oak sandhills and old fields. Bottomland habitats are represented by riverine forest, cypress domes, fresh water marshes, salt marshes and mangroves. Upland habitats are utilized by those amphibians and reptiles that do not require abundant moisture, such as toads, tortoises, lizards, certain frogs and snakes. Toads occurring in pine flatwoods are the oak toad (Bufo quercicus) and the southern toad (B. terrestris). The pine woods treeefrog (Hyla femoralis) is also found in the Planning Area and is arboreal, climbing high in trees in pine flatwoods.

Several lizards are found in the flatwoods. The six-lined race-runner (Cnemidophorous sexlineatus) and the slender glass lizard (Ophisaurus attenuatus) prefer the open, dry habitats found here and in old fields.

Snake species which occur in the flatwoods or old field habitats include the southern black racer (Coluber constrictor priapus), southern hognose snake (Heferodon simus), eastern coachwhip (Masticophis flagellum), corn snake (Elaphe guttata), Florida kingsnake (Ampropeltis getulus floridania), the eastern diamondback rattlesnake (Crotalus adamanteus and the dusky pygmy rattlesnake (Sistrurus miliarius barbouri). The black racer and coachwhip are two very active species that frequent open, grassy areas. They feed primarily on rodents and birds but also eat frogs, toads and other snakes. Hognose snakes are common residents of dry, sandy areas feeding mainly on toads and frogs. The corn snake and kingsnake are colorful and have been exploited for the pet trade. They are constrictors and can be important in rodent control in localized areas. Kingsnakes also eat birds, bird eggs and other snakes including venomous species. The diamondback rattler is a large, dangerous snake which frequents pine flatwoods which contain abundant palmetto and wiregrass understory. They feed on rabbits, rodents and occassionally birds and frequently coexist with other residents of burrows constructed by the gopher tortoise. The pygmy rattler is a diminuitive snake seldom exceeding 18 inches in length. Food includes mice, lizards, other snakes and frogs.

Snakes are exclusively carnivorous and swallow their prey whole. Many of the snakes occurring in the Planning Area play an important role in rodent population control. Those areas where snakes have been removed usually experience dramatic increases in numbers of mice and rats. Snakes themselves are preyed upon by hawks, owls, foxes, skunks, bobcats and feral hogs. Man is also a major factor in snake mortality either from direct killing of individuals or through habitat destruction.

The Florida box turtle (Terrapene carolina bauri) is a common resident of upland areas. This docile turtle is omnivorous, feeding on berries, fungi, earthworms and insects.

Many species are found primarily in sandhill habitats. In addition to those discussed previously are the Florida gopher frog (Rana areolata aesopus), Florida scrub lizard 1(Sceloporus woodi), eastern indigo snake (Drymarchon corais) and the gopher tortoise (Gopherus polyphemus). The sandhill habitat and its inhabitants are threatened with extinction due to development for residential, agricultural or industrial use. Therefore, all of these species have a special status in Florida and are discussed in the Threatened and Endangered Species section of this report.

Amphibians and reptiles are especially abundant in the bottomland habitats since many of these species need to be close to water. This is especially true of frogs such as the bullfrog (Rana catesbeiana), Southern leopard frog (R. pipiens), green treefrog (Hyla cinera) and ornate chorus frog (Pseudacris ornata). The bullfrog is a large frog which inhabits permanent water bodies. Leopard frogs are common in most water bodies but will wander away from water during the summer. Treefrogs and chorus frogs are small frogs more commonly heard than seen. They occur near shallow, often temporary, bodies of water and generally conceal themselves in vegetation. These frogs feed on minute arthropods and are themselves important food items for herons, egrets and other water birds. They are also eaten by larger fish, snakes, alligators, skunks, and raccoons.

The bottomland habitats are considered the most likely locations to find salamanders. The slimy salamander (Plethodon glutinosus) occurs under logs and debris in moist areas while the Florida newt (Notopthalmus viridescens piaropicola) and two-toed amphiuma (Amphiuma means) occur in aquatic situations such as ditches, swamps, and marshes. The southern dusky salamander (Desmognathus auriculatus) prefers cypress ponds where it feeds on aquatic invertebrates.

Many aquatic turtles are found in the swamp and marsh habitats. The Florida snapping turtle (Chelydra serpentina oscola) and Florida soft-shell (Trionyx ferox) are common inhabitants of canals, ponds, lakes, and swamps. The Florida red-bellied (Chrysemys nelsoni) and Chicken (Deirochelys reticularia) turtles are commonly observed sunning on logs and along the shore of streams and lakes. The ornate diamondback terrapin (Malaclemys terrapin macrospilota) is the primary turtle of brackish and salt marsh habitats and is often found in mangrove areas. These turtles feed on small aquatic invertebrates, fish, reptiles, carion, and some vegetation. Many turtle species are caught for human consumption.

The most numerous snake species in the aquatic environments are the water snakes (Natrix sp.) and swamp snakes (Liodytes sp. and Seminatrix sp.). These snakes are commonly seen along lake borders and in shallow water of swamp and marsh habitats. They are often mistaken for the venomous cottonmouth (Agkistrodon piscivorus) which frequents similar habitats. The peninsula ribbon snake (Thamnophis sauritus sackeni) is a semiaquatic species that occurs in moist areas of bottomland habitats. These snakes feed primarily on aquatic life such as frogs, fish and salamanders. Cottonmouths commonly include rodents, birds and other snakes in their diet.

One of the more familiar reptiles in Florida is the alligator (Alligator mississippiensis). The alligator is common in most aquatic situations and will venture into brackish water. They are voracious feeders eating anything they can capture although primary food items are fish and turtles. The alligator has suffered from habitat reduction and hunting for its hide and was once considered endangered but is making a strong comeback in many portions of its range, especially Florida. A further discussion of this species is presented in the Treatened and Endangered Species section.

Birds - The Florida peninsula provides a meeting place for tropical and northern temperate bird species. The diverse habitats available in the Tampa Bay Region attract many different bird species. The salt and fresh

TABLE I.4-5

BIRDS OF HILLSBOROUCH COUNTY, FLORIDA

Common Name	Preferred Habitat	Conservation Status/ Comments
Yellow-Crowned Night Heron	9/W	SC
Eastern Least Bittern	3,10/WBT	SC
American Bittern	3,WT	BL
Wood Ibis	3,9,10/W	E
Glossy Ibis	9,10	ES
White Ibis	1,3,9,10/BW	SC
Roseate Spoonbill	9/W	T
Blue Goose	9/WT	Game
Mallard	3,4,10/WT	Game
Black Duck	9/W	Game
Florida Duck	9,10/WT	Game
Gadwall	9,10/WT	Game
Pintail	9,10/WT	Game
Green-Winged Teal	9,10/WT	Game
Blue-Winged Teal	9,10/WT	Game
European Wigeon	4,9,10/WT	Game
American Widgeon	4,9,10/WT	Game
Northern Shoveler	3,4,9,10/WT	Game
Wood Duck	1,3,4/BW	Game
Redhead	9,10/WT	Game
Mottled Duck	9,10/BW	Game
Southeastern American Kestrel	2,11/WB	TH
Common Night Hawk	1,2,8/WTB	BL
Short-Tailed Hawk	1,2,7/BW	TH
Bobwhite	1,2,4/BW	Game
Wilk Turkey	1,2,4,11/BW	Game
Florida Sandhill Crane	2,7,8,11/BW	TH
Limpkin	1,3,4,10/WB	ES
King Rail	3,10/BT	BL, Game
Clapper Rail	9/W	Game
Virginia Rail	3,10/W	Game
Sora	3,10/W	Game
Black Rail	9/WB	SU
Common Gallinule	3,10/BW	Game
American Coot	3,9,10/W	Game
Purple Gallinule	1,10,3/WB	ES
American Oystercatcher	9/WB	BL, TH
Semipalmated Plover	9/WB	
Pipling Plover	9/W	BL, SC
Snowy Plover	9/WB	BL, E
Wilson's Plover	9/W	
Killdeer	7,8/WB	

Reproduced from best available copy.

(Continued)

TABLE I.4-5 (Continued)

Common Name	Preferred Habitat	Conservation Status/ Comments
Black-Bellied Plover	9/WT	
Ruddy Trunstone	9/WT	
American Woodcock	1,10/W	Game
Common Snipe	3,10/W	Game
Long-Billed Curlew	9/T	
Whimbrel	9/T	Accidental (European)
Spotted Sandpiper	9/WB	
Solitary Sandpiper	9/W	
Willett	9/W	
Greater Yellowlegs	9/W	
Lesser Yellowlegs	9/T	
Red Knot	9/T	
Pectoral Sandpiper	9/T	
White-Rumped Sandpiper	9/T	
Least Sandpiper	9/W	
Dunlin	9/T	
Long-Billed Dowitcher	9/W	
Short-Billed Dowitcher	9/W	
Stilt Sandpiper	9/T	
Semipalmated Sandpiper	9/W	
Western Sandpiper	9/W	
Marbled Godwit	9/W	
Sanderling	9/T	
American Avocet	9/T	SC
Black-Necked Stilt	9/WB	
Wilson's Phalarope	9/T	
Norther Phalarope	9/T	
Great Black-Backed Gull	9/W	
Lesser Black-Backed Gull	9/W	
Herring Gull	9/W	
Ring-Billed Gull	9/T	
Black-Headed Bull	9/T	European
Laughing Gull	9/W	
Bonaparte's Gull	9/T	
Forster's Tern	9/WB	
Common Tern	9/W	
Royal Tern	9/W	SC
Sandwich Tern	9/W	SC
Caspian Tern	9/W	
Black Skimmer	9/BW	SC
Least Tern	9/W	BL, TH
Black Tern	9/T	
Common Loon	9/W	
Horned Grebe	9/W	
Pied Billed Crebe	10/W	

(Continued)

TABLE I.4-5 (Continued)

Common Name	Preferred Habitat	Conservation Status/ Comments
White Pelican	9/W	
Brown Pelican	9/BW	T
Rock Dove	5/BW	Feral/ES
Mourning Dove	2,4,6,7,11/WB	Game
Ground Dove	7,8/BW	
Ringed Turtle Dove		
Monk Parakeet		Introduced/ ES
Canary-Winged Parakeet	5/WB	Introduced/ ES
Budgerigar	5/WB	Introduced/ ES
Yellow-Billed Cuckoo	9,10/TB	BL
Smooth-Billed Ani	3/T	
Barn Owl	5,7/BW	BL/ES
Screech Owl	1,2,11/BW	ES
Great Horned Owl	1,3,11/BW	ES
Burrowing Owl	2,8,11/BW	BL, SC
Barred Owl	1,9,11/BW	ES
Short-Eared Owl	3/W	BL, ES
Chuck-Will's Widow	1,3,11/WB	
Whip-poor-will	1,2,11/BW	ES
Belted Kingfisher	1,10/BW	ES
Common Flicker	1,2,11/BW	
Pileated Woodpecker	2/BW	ES
Red-Bellied Woodpecker	1,2/BW	
Red-Headed Woodpecker	1,2/BW	BL, ES
Yellow-Bellied Sapsucker	1,2,7/W	
Hairy Woodpecker	1,2/WB	BL, SC
Downy Woodpecker	1,2/BW	
Red-Cockaded Woodpecker	2/B	E
Eastern Kingbird	2,4,7/WBT	
Western Kingbird	9/T	
Scissor-Tailed Flycatcher	1,2,9/T	
Great Crested Flycatcher	1,2,11/WB	
Eastern Phoebe	4/W	
Gray Kingbird	9/BW	
Tree Swallow	1,3/W	
Chimney Swift	5/B	
Ruby-Throated Hummingbird	1,5/B	
Barn Swallow	1,5/B	
Rough-Winged Swallow	5,10/T	
Purple Martin	5/B	BL
Blue Jay	2,4,5/BW	
Common Crow	2,7,11/BW	
Florida Scrub Jay	11/BW	
Fish Crow	9,11/BW	
Carolina Chickadee	2,4,11/BW	

Reproduced from best available copy.

(Continued)

TABLE I.4-5 (Continued)

Common Name	Preferred Habitat	Conservation Status/ Comments
Tufted Titmouse	1,11/BW	
Brown-Headed Nuthatch	2/BW	ES
House Wren	5,6,8/W	
Carolina Wren	5,6,11/BW	
Long-Billed Marsh Wren	3,11/W	
Short-Billed Marsh Wren	3,11/W	
Mockingbird	4,5,11/BW	(State Bird)
Catbird	5,7,11/W	
Brown Thrasher	4,6,7/WB	
American Robin	5,11/W	
Hermit Thrush	1,11/W	
Eastern Bluebird	2/BW	
Blue-Gray Gnatcatcher	1,5,11/WB	
Ruby Crowned Kinglet	2,11/WB	
Water Pipit	6,7,11/W	
Cedar Waxwing	5,11/WT	
Loggerhead Shrike	2,11/BW	BL, ES
Starling	4,5,6/WT	Introduced/ ES
White Eyed Vireo	1,10,11/WB	
Solitary Vireo	1/WT	
Red-Eyed Vireo	1/BT	
Black-and-White Warbler	1/WT	
Prothonotary Warbler	1/TW	
Orange-Crowned Warbler	1/TW	
Northern Parula Warbler	1/BT	
Yellow-Rumped Warbler	1,2,11/WT	
Blackpoll Warbler	1/T	
Black-Throated Green Warbler	1/T	
Black-Throated Blue Warbler	1/T	
Blackburnian Warbler	1/WT	
Yellow-Throated Warbler	1/BW	
Pine Warbler	1/BW	
Prairie Warbler	2,11/T	SC, Nests in mangrove trees
Palm Warbler	1,3,11/WT	
Ovenbird	1/TW	
Northern Waterthrush	1,3/TW	
Louisiana Waterthrush	1/T	
Common Yellowthroat	1,2,11/BWT	
Yellow-Breasted Chat	1,2,11/TB	
American Redstart	1T	"peripheral breeder"
House Sparrow	5,11/BW	

(Continued)

TABLE I.4-5 (Continued)

Common Name	Preferred Habitat	Conservation Status/ Comments
Eastern Meadowlark	2,11/WB	
Red-Winged Blackbird	3,4,6,10/WB	
Northern Oriole	2,7,11/T	
Rusty Blackbird	1,11/WT	
Boat-Tailed Grackle	1,3,11/BW	
Common Crackle	1,3,11/BW	
Brown-Headed Cowbird	2,3,11/W	
Blue Grosbeak	1,7,11/T	
Cardinal	5,11/BW	
Summer Tanager	5,11/BT	
Western Tanager	5,11/T	
Rose-Breasted Grosbeak	1/T	
Indigo Bunting	4,7,11/T	
Purple Finch	2,11/W	
Pine Siskin	2,11/T	
American Goldfinch	2,11/W	
Rufous-Sided Towhee	1,6/BW	
Savannah Sparrow	2/WT	
Grasshopper Sparrow	2/WT	
LeConte's Sparrow	3,11/WT	
Sharp-Tailed Sparrow	9/W	
Vesper Sparrow	2/W	
Backman's Sparrow	2/BW	BL, ES
Lark Sparrow	2/W	
Chipping Sparrow	2/BW	
Field Sparrow	2,7,8/WB	
White Crowned Sparrow	2,7/T	
White Throated Sparrow	2,7,11/W	
Swamp Sparrow	3,7/WT	
Song Sparrow	7,11/W	
Ring-Necked Duck	3,4,9/WT	Game
Canvasback	9/W	BL/Game
Lesser Scaup	3,9,10/WT	Game
Bufflehead	9/WT	Game
Oldsquaw	9/WT	Game
Ruddy Duck	9/W	Game
Hooded Merganser	3,10/W	Game
Red-Breasted Merganser	9/W	Game
Turkey Vulture	1,2,4,6/BW	ES
Black Vulture	1,2,4,6/BW	ES
Sharp-Shinned Hawk	1,2,10/WB	BL, ES
Cooper's Hawk	1,2,10/WB	BL, SC
Red-Tailed Hawk	1,2,7,8/BW	ES
Red-Shouldered Hawk	1,2,7,8/BW	BL, ES
Broad-Winged Hawk	1,2,11/WB	ES
Southern Bald Eagle	1,2,9,10/W(B)	TH
Marsh Hawk	1,3,10/W	BL, ES

Reproduced from best available copy.

(Continued)

TABLE I.4-5 (Continued)

Common Name	Preferred Habitat	Conservation Status/ Comments
Osprey	1,3,4,9,10/BW	BL, TH
Peregrine Falcon	9,10/T	E
Audubon's Caracara	1,7,11/T	BL, TH
Merlin	1,7,11/W	BL, SU
White-Tailed Kite	3,7,8/T	R

1 = Mixed Hardwoods
2 = Pine Flatwoods
3 = Cypress Dome or Freshwater Marshes
4 = Rural (roads edge)
5 = Urban
6 = Citrus Grove
7 = Oldfield
8 = Pasture
9 = River, Bay (or estuary)
10 = Fresh Water (ponds, canals and ditches)
11 = Other

BL = "Blue Listed"
E = Endangered
TH = Threatened
R = Rare
SC = Species of Special Concern
SU = Status Undetermined
ES = Ecologically Significant
G = Game Species
W = Wintering
B = Breeding
T = Transiety

Source: Courser, 1978; Dames & Moore, 1975; Palmer, 1962; Petersen, 1947 and USEPA, 1978 water marshes support resident shorebirds and wading birds which are joined by multitudes of migratory waterfowl during the fall and spring seasons. Many of these migratory species overwinter in the area. The upland habitats support many types of birds, depending on the dominant vegetation. Migratory species, such as warblers, thrushes and doves also augment the resident populations in these areas. There are over 230 bird species known to occur in the Tampa Bay area and these are listed in Table I.4-5 along with their habitat preference.

Many birds preferring aquatic environments are found in the Planning Area. Ducks such as the mallard (*Aras platyrhychos*), pintail (*A. acuta*), greenwinged teal (*A. crecea*), redhead (*Aythya americna*), canvasback (*A. valisineria*) and lesser scraup (*A. affinis*) are common in all waterbodies, especially during the migratory seasons. Many of the ducks prefer the open bay and estuaries where they feed on bottom vegetation while others prefer inland swamps and cypress ponds. The wood duck (*Aix sponsa*) and Florida duck (*Anas fulvigula*) are important resident species occurring in hardwood swamps where they feed on acorns and aquatic vegetation and seeds.

Shorebirds are numerous in the marsh habitats. These include rails (*Rallus* sp.), plovers (*Charadris* sp.), sandpipers (*Actitis* sp., *Tringa* sp., *Ervlia* sp., and *Ereunetes* sp.), gulls (*Larus* sp.) and terns (*Sterna* sp.). Rails, plovers and sandpipers actively feed along shorelines and in the marshes where they forage for insects and small aquatic animals. Gulls are scavengers, feeding on anything available. Terns locate much of their food from the air, feeding on small fish and insects.

Wading birds are common in the swamp forests, freshwater marshes and salt marshes. These include the great blue heron (*Ardea herodies*), green heron (*Butorideus striatus*), little blue heron (*Florida coerulea*), common egret (*Casmerodius albus*), snowy egret (*Egretta tricolor*), wood ibis (*Mycteria americana*) and white ibis (*Endocumius albus*). These long legged birds wade along shorelines and through marsh grass in search of mollusks, crustaceans, fish and aquatic insects. These and other aquatic birds have become less numerous than in the past due to habitat loss from draining and development. Several of these species have special status in Florida and are further discussed in the Treatened and Endangered Species section.

An extremely varied bird population exists in the forested regions of the Tampa Bay area. Woodpeckers (*Centurus carolinus*, *Melanerpes erythrocephalus*, and *Picoides* sp.) are common wherever there are dead trees available in which to construct den holes and locate wood boring insects for food. The great-crested flycatcher (*Myiardus crinitus*), eastern phoebe (*Sayorius phoebe*), hermit thrush (*Hylocichla gutteta*), blue-gray gnat-catcher (*Polioptila coerulea*) and vireos (*Vireo* sp.) are also expected in hardwood forests. A multitude of warblers (*Dendroica* sp.) and sparrows may be found in several different habitats ranging from hardwood forests to pine flatwoods to old field. Food items for these birds vary from seeds and berries to insects, depending on habitat preference and food availability.

Hawks and owls are well represented in this region of Florida. Red-tailed (*Buteo jamaicensis*), red-shouldered (*B. lineatus*) and marsh hawks (*Circus cyaneus*) are common residents of wooded areas near old field and open areas in which they locate their rodent prey. Falcons

(*Falco* sp.) are less common but are occasionally seen capturing birds for food. The barn owl (*Tyto alba*), screech owl (*Otus asio*), great horned owl (*Bybo virginianus*) and barred owl (*Strix varia*) are found in similar habitats as hawks but they are active at night. The osprey (*Pandion halioetus*) and southern bald eagle (*Haligeetus leucocephalus*) are large, predatory birds which are occasionally seen searching for fish over open bodies of water.

Several species of birds have adapted to major habitat alterations. These cosmopolitan species are occasional pests in agricultural areas. These species include the cros (*Corvus brachyrhynchos*), brown-headed cowbird (*Molothrus oter*), starling (*Sturnus vulgaris*), pigeon (*Columba livia*) and house sparrow (*Passer domesticus*). These are all flocking birds and can be quite destructive to grain and fruit crops when they descend on an area in large numbers. Other birds in residential or rural settings include the cardinal (*Richmondena cardinalis*), mocking-bird (*Mimus polyglottos*), robin (*Turdus migratorius*) and bluebird (*Sialia sialis*). These birds are equally at home in the backyard of a house, in dense hedgerows in agricultural areas or in forest habitats.

The game bird species in Florida include all of the ducks listed in Table 3.4-5 as well as the wild turkey (*Melegris gallopavo*), bobwhite (*Colinus virginianus*), woodcock (*Philohela minor*) and snipe (*Capella gallinago*). The wild turkey is a bird of the deep riverine forests while the bobwhite is most commonly found in old fields and pine flatwoods with an open understory. Woodcock and snipe prefer moist areas such as hardwood and cypress swamps.

TABLE I.4-6

MAMMALS

Common Name	Preferred Habitat	Conservation Status/ Comments
Eastern Pipistrel	Wooded areas and farm buildings.	
Southeastern Myotis	Hollow trees and underneath bridges.	
Red Bat	Swamps and hammocks.	Nocturnal
Yellow Bat	Pinewoods.	Solitary/nocturnal
Seminole Bat	Swamps and hammocks.	
Evening Bat	Pinewoods and farm buildings.	Colonial
Eastern Big-eared Bat	Woodlands and farm buildings.	Rare
Mexican Freetail Bat	Caves and farm buildings.	Colonial/insectivorous
Big Brown Bat	Caves and farm buildings.	Rare
Gray Fox	Pine flatwoods.	Omnivorous, secretive fur bearer
Red Fox	Pine flatwoods.	Introduced species/ omnivorous, chiefly nocturnal
Florida Water Rat	Marshes and wet prairie.	Protected fur bearer special concern
Rice Rat	Wet prairie, marshes.	Nocturnal, semi-aquatic
Eastern Woodrat	Hammocks, swamps and cabbage palmetto.	Uncommon
Norway Rat	Warehouses, farm buildings, closely associated with man made structures.	Pest species
Black Rat	Urban areas and buildings.	Pest species

(Continued)

TABLE I.4-6 (Continued)

Common Name	Preferred Habitat	Conservation Status/ Comments
Cotton Rat	Old field and dry prairie.	Disruptive to ground nesting birds
House Mouse	Farm buildings, residences and old field.	Omnivorous, prolific pest species
Golden Mouse	Oak hammocks.	Tree climbing
Cotton Mouse	Swamps and hammocks.	Tree climbing
Oldfield Mouse	Old field, well drained pasture.	Feeds on seeds and berries
Florida Deer Mouse	Old field, well drained scrub hammocks.	Large mouse, sometimes found in gopher tortoise burrows. Threatened
Eastern Harvest Mouse	Old field and marshes.	
Short-Tailed Shrew	Forests, grasslands and lawns.	Omnivorous
Least Shrew	Grasslands and marshes.	Insectivorous
Southern Flying Squirrel	Riverine swamps and cypress heads.	Nocturnal
Eastern Gray Squirrel	Riverine swamps, oak hammocks.	Aboreal omnivorous, prefers fruits and nuts
Eastern Fox Squirrel	Pine flatwoods.	Omnivorous, shermani subspecies. Threatened
White-Tailed Deer	Swamps, marshes and bushy woodlands.	Popular game species, browser
Wild Pig	Pine flatwoods and hammocks.	Introduced as game, ecologically destructive
Striped Skunk	Old field and pine flatwoods.	Chiefly nocturnal
Spotted Skunk	Pine flatwoods near streams.	Omnivorous, nocturnal

(Continued)

TABLE I.4-6 (Continued)

Common Name	Preferred Habitat	Conservation Status/ Comments
Eastern Cottontail	Old field, citrus groves.	Generally nocturnal game species
Marsh Rabbit	Hammocks, swamps and marshes.	Chiefly nocturnal game species
Panther	Large tracts of mixed vegetation types forests and swamps.	Endangered
Bobcat	Swamps, pine flatwoods and hammocks.	Nocturnal, secretive predatory
Nine-Banded Armadillo	Pine flatwoods, hammocks.	Omnivorous, prefers insects
Opossum	Pine flatwoods, improved pasture and croplands.	Omnivorous and nocturnal
Southeastern Pocket Gopher	Pine flatwoods.	Ecologically significant
River Otter	Swamps, hammocks and lake fringes.	Highly aquatic fur bearer, very active
Lone-Tailed Weasel	Unrestricted, all major terrestrial.	Predatory in nature, small mammals and birds especially nocturnal. Rare
Mink	Swamps, lake fringes.	Rare
Raccoon	Hammocks and swamps.	Omnivorous, partial to stream systems/ fur bearer
Eastern Mole	Wet prairie, lawns and moist fields.	Insectivorous
Nutria	Marshes and swamps.	Introduced if present
Florida Manatee	Brackish water lagoons, river mouths.	Endangered

Source: Burt, et al., 1976; Dames & Moore, 1975; Naggiar, 1979 and USEPA, 1978

Mammals - There are over 40 species of mammals documented as occurring in the Planning Area. These species are listed in Table I.4-6 along with their habitat preference and conservation status. The majority of these mammals are secretive or nocturnal and thus are rarely seen. Rodents and bats account for one half of the area's mammals. Bats are generally sighted at dusk as they fly across roads and between trees chasing flying insects, their primary food item. Bats may be solitary or colonial depending on the species. Some roost in trees while others prefer attics and lofts of barns and houses. The most common rodent species are those that have become closely associated with man - the Norway rat (*Rattus norvegicus*), black rat (*R. rattus*), and house mouse (*Mus musculus*). These pests are usually found in warehouses, farm building and any location where food is stored. Their diet varies according to food available. Wild rodents most common in the Planning Area include the cotton rat (*Sigmodon hispidus*), old field mouse (*Peromyscus polionotus*), and deer mouse (*P. floridanus*). These species occur in old field and pine flatwood habitats where they feed on vegetation, seeds, fruit and insects. Swamp forest habitats commonly contain the woodrat (*Neotoma floridana*), cottonmouse (*Peromyscus gossypinus*) and golden mouse (*Ochaotomys nuttalli*). The rice rat (*Oryzomys palustris*) is primarily associated with wet prairies and marsh habitats.

Mammals expected in the upland habitats would include the armadillo (*Dasypus novemcinctus*), cottontail (*Sylvilagus floridanus*), striped skunk (*Mephitis mephitis*), fox squirrel (*Sciurus niger*), gray fox (*Urocyon cinereoargenteus*) and red fox (*Vulpes fulva*). The armadillo originally occurred in central America but has recently extended its range into the southeastern United States. It feeds entirely on insects and other invertebrates it digs out of the sandy soil. The cottontail is a common rabbit in brushy areas and old fields. It is a vegetarian, feeding on plant growth in the spring and summer and bark and stems in the winter. The skunk in omnivorous, feeding on insect grubs, fruit, eggs and small animals in a variety of habitats. The fox squirrel is a resident of the pine flatwoods where pine seeds are its major food source. Foxes are predators but the gray fox has a more varied diet than the red fox as the former includes berries, fruit and insects in its diet while the latter limits itself primarily to meat in the form of mice, rats, birds and rabbits.

The bottomland habitats provide a home for species such as the gray squirrel (Sciurus carolinensis), flying squirrel (Glaucomys volans), marsh rabbit (Sylvilagus palustris), opossum (Didelphis marsupialis), raccoon (Procyon lotor), bobcat (Lunx rutus), whitetail deer (Odocoileus virginianus) and wild pig (Sus scrofa). Squirrels feed on acorns, nuts, and fungi and make their homes in cavities in hardwood trees. The marsh rabbit is alarge rabbit that feeds primarily on the vegetation growing in moist bottomland habitats. Opossums and raccoons are most active at night and feed on almost anything they find. The opossum is especially fond of carrion and is an active scavenger. The raccoon prefers fish, crayfish, salamanders, frogs and other aquatic life available along streams and in ponds. The bobcat is a very effective predator that feeds on rodents, rabbits and other small mammals. These cats require large areas of forested habitat and therefore are unable to survive in many areas of the Tampa Bay Region. The deer is the primary game species in the south.

They are browsers rather than grazers and feed on acrons, palmetto berries, buds, twigs and other vegetation. Deer adapt well to agricultural areas by changing their feeding habits to include crops, in which case, they can be detrimental to cotton and soybeans. Wild (feral) pigs are also becoming common in the bottomland areas of Florida. They feed on many of the same food items preferred by deer but also include fungi, roots, tubers, amphibians, snakes and small mammals in their varied diet. These pigs have become disruptive in many areas due to their habit of rooting deep in the soil for food.

Those mammals considered game animals include squirrels, rabbits, deer and pigs. Others which are trapped for fur include the fox, skunk, bobcat, opossum, raccoon, otter (Lutra canadensis) and nutria (Myocastor coypus). The bobcat and otter are becoming rare in Florida because of exploitation for fur and habitat removal. The nutria is an introduced species from South America that is probably not yet well represented in the Planning Area.

c. Threatened and Endangered Species: The Planning Area provides habitats suitable for a number of threatened or endangered species. Included in the categories of endangered, threatened, rare and species of special concern are 53 vertebrate species in the Planning Area including eight mammals, 34 birds, 10 reptiles, and 1 amphibian. This list represents 64 percent of the species listed for the State of Florida.

In 1973, the United States Congress passed the "Endangered Species Act" (Public Law 93-205). This bill acknowledged the impact of human activity upon native wildlife. Conservation policy and the mechanics for management review were outlined in this legislation. Many states followed suit with similar legislation directed as preserving indigenous flora and fauna. In 1974, the Florida Game and Fresh Water Fish Commission (G&FWFC) adopted a resolution by which the commission staff was directed to provide the public with a listing of those species in the state deserving special conservation consideration and a preliminary listing of 34 species was developed by the G&FWFC staff. Florida's "Endangered Species Act of 1977", included in its provisions the creation of an Endangered and Threatened Species Advisory Council to investigate and review the program and to make recommendations to the G&FWFC. Subsequently, the Florida Committee on Rare and Endangered Plants and Animals (FCREPA) was convened. In late 1978, a four volume reference series was published for the G&FWFC, co-sponsored by the Florida Audubon Society and the Florida Defenders of the Environment.

Threatened and endangered species (inclusive term) are especially sensitive to management policies and practices and seven categories for conservation status have been developed. These categories are as follows:

Endangered - Species in danger of extinction if the deleterious factors affecting their populations continue to operate. These are forms whose numbers have already declined to such a critically low level or whose habitats have been so seriously reduced or degraded that without active assistance their survival in Florida is questionable.

Threatened - Species that are likely to become endangered in the state within the foreseeable future if current trends continue. This category includes (1) species in which most or all populations are decreasing because of overexploitation, habitat loss or other factors; (2) species whose populations have already been heavily depleted by deleterious conditions and which, while not actually endangered, are nevertheless in a critical state; and (3) species which may still be relatively abundant but are being subjected to serious adverse pressure throughout their range.

Rare - Species which, although not presently endangered or threatened as defined above, are potentially at risk because they are found only within a restricted geographic area or habitat in the state or are sparsely distributed over a more extensive range. This includes peripheral breeding species.

Species of Special Concern - Species that do not clearly fit into one of the foregoing categories yet warrant special attention. Included in this category are species that (1) may be relatively abundant and widespread in the state but are especially vulnerable to certain types of exploitation or environmental changes and have experienced long term population declines, or (2) have a potential impact on endangered or threatened populations of the same or other species outside the state.

Status Undetermined - Species that are under consideration for protected status includes species that are blue listed by the Florida Audubon Society.

Recently Extirpated - Species that have disappeared from Florida since 1600 but still exist elsewhere.

Recently Extinct - Species that have disappeared from the state since 1600 through extinction.

Threatened and endangered mammals within the Planning Area (exclusive of the cetaceans) are found in all of the major terrestrial habitats. However, these species are characteristically restricted to certain habitat types, such as wetlands (Layne, 1978). The Florida

Panther (Felis concolor coryi, endangered) is considered as one of the less restricted mammals reported to inhabit the Planning Area. This panther requires large tracts of relatively undisturbed mixed vegetation types, and frequents swamps, marshlands, and woodlands feeding on deer and small mammals but rarely on domesticated livestock. As a predator, the Florida Panther has been considered an enemy of man and has been hunted in the past (Williams, 1978).

Birds are the most numerous species listed in the various conservation categories. More is known about avifauna in general than about other animals because of the more conspicuous nature of birds and the abundance and diversity of bird species found within the various habitats. Many birds are restricted to particular habitat types and/or feeding or breeding requirements, so are understandably listed as warranting special attention. As noted by Woolfenden (1966, 1974) and others, wintering and winter breeding populations of birds in Florida are many times more diverse and numerous than risident breeding populations. Additionally, remnant populations of what were originally western (continental U.S.) prairie and scrub species occur in the Hillsborough County Planning Area. These species include the Florida Sandhill Crane (Grus canadansis pratensis, threatened), the White-tailed Kite (Elanus caereleus majusculus, rare), the Short-tailed Hawk (Buteo brachyurus, rare) and the Florida Burrowing Owl (Athena cunicularia floridana, special concern).

The Southern Bald Eagle (Haliaeetus leucocephalus leucocephalus, threatened) and the Fish Hawk or Osprey (Pandion halioetus carolinensis, threatened) both occur and nest within the Planning Area. These raptors occur more abundantly in Florida terrain than in other stretches of their respective historical ranges. However, habitat alterations and impacts from accumulated pesticide residues in the predator's food chains threatens the continued survival of both of these species.

Several of the marsh dependent species, e.g., limpkins, herons and egrets,are listed as species of special concern because of the continuing threat upon wetlands. Many bird species are listed as Status Undetermined by the FCREPA or are "Blue Listed" by the Florida Audubon Society (FAS) due to the lack of supportive data with which more reliable decisions toward status and possible managment criteria might be developed.

An example of a peripheral breeding species is the American Redstart (Setophaga ruticilla ruticilla, rare) which is not uncommon in its native range but is rarely observed foraging and/or breeding through its Florida flyway corridor.

The only amphibian listed within the Planning Area is the Florida Gopher Frog (Rana areotate aesopus, threatened). This small frog is known to inhabit stump holes and crawfish burrows but more often is associated with the burrow of its namesake, the Florida Gopher Tortoise (Gopherus polyphemus, threatened). Habitat impacts or other activities by man that are deleterious to the fate of the Gopher Tortoise are also believed to adversely affect the Gopher Frog.

Threatened and endangered species of reptiles within the Planning Area include the Florida Gopher Tortoise, the Florida Scrub Lizard (Sceloporus woodi, rare) and the Eastern Indigo Snake (Drymarchon corais couperi, special concern).

The burrowing Florida Gopher Tortoise is a threatened species and also provides ecologically significant habitat for no fewer than three dozen other commensal inhabitants (Auffenberg, 1978). Some of the more important vertebrates found in association with the gopher tortoise are the Florida Pine Snake (Pituophis melanoleueus migitus); the Eastern Indigo Snake, special concern; the Florida Mouse (Peromyscus floridanus, threatened); and the Florida Gopher Frog, threatened. The burrow provides for the constant temperature and humidities these symbiotic organisms prefer. The gopher tortoise is basically a vegetarian and tortoise eggs and smaller hatchlings provide food for raccoon, snakes, and birds of prey. Considered as a delicacy, the Florida Gopher Tortoise has been hunted and depleted from most of its historical native range. This has resulted in placing the Gopher Tortoise on lists for official conservation status and as an official game species, simultaneously. Habitat alteration by general development in well drained, sandy ridge areas has also led to the decline of these populations. Relatively slow reproductive rates complicate efforts to relocate and to restore the gopher tortoise to tracts of suitable habitat.

The Florida Scrub Lizard is believed to inhabit the "scrub" ridges within the Planning Area. Characteristic turkey oak-longleaf pine associations and well drained sandy soils in citrus groves provide the Florida Scrub Lizard and its relative the Southern Fence Lizard (Sceloporus undulatus), foraging range, although the southern Fence Lizard prefers to remain more arboreal. Habitat alteration through development for housing has been the greatest threat to the Florida Scrub Lizard, although these lizard populations are observed to be discontinuous even in areas of prime habitat.

The Eastern Indigo Snake is a regular inhabitant of both moist hammocks and pine flatwoods. The range of the indigo snake extends into the sandhill habitats and into ecotones around recently logged forest areas in association with the Gopher Tortoise. The burrow of the Gopher Tortoise provides for the cooler moist atmosphere the Indigo requires. The Indigo's attractive appearance and mild temperment has made this species a collecting target for the pet trade. Recommendations for enhancing Indigo snake poplations include safeguarding the xeric hammock communities that the snake inhabits, strict enforcement of prohibition on collecting and handling specimens and protection for the Gopher tortoise (Kockman, 1978).

The American Alligator is neither threatened nor endangered in Florida. Alligator populations are resilient and have responded well to recent efforts to increase their numbers. Alligators inhabits almost all fresh water wetland areas throughout the peninsula of Florida, and are found in canals and borrow pits as well as rivers, lakes, ponds and open marshes. The juvenile alligator eats insects, crustaceans and mollusks, and in turn is preyed upon by raccoons, wading birds and black bass. Adult alligators feed on fish, snakes, turtles, birds and small mammals. Alligator holes or den sites provide suitable conditions for development of shrubs (e.g. groundsel or salix willow) where perching birds may be attracted. The use of these den sites as watering holes by area wildlife also becomes important in times of drought when these holes may be the only available habitat for fish in the vicinity.

I.5 WETLANDS AND LAND/WATER INTERFACE

The Planning Area contains extensive wetlands that are of vital ecological importance. These wetland areas are found along the coastal zones of Tampa, Hillsborough, McKay and Old Tampa Bays; along the shorelines of the numerous lakes and ponds; along the shorelines and in the headwaters of the Hillsborough, Alafia, and Little Manatee River drainage basins; and in other low, flood prone areas.

Wetlands in the Planning Area provide a source of drinking water for the citizens of Tampa and the surrounding area. Additionally, they store water and moderate the flooding effects of storms. The vegetation in the marshes and floodplains also serves to aid in the uptake of polluting nutrients and settling of sediments. Development in thr Planning Area has encroached on these wetlands and floodplain areas, modifying their drainage characteristics, and increasing the chances of flooding within residential areas.

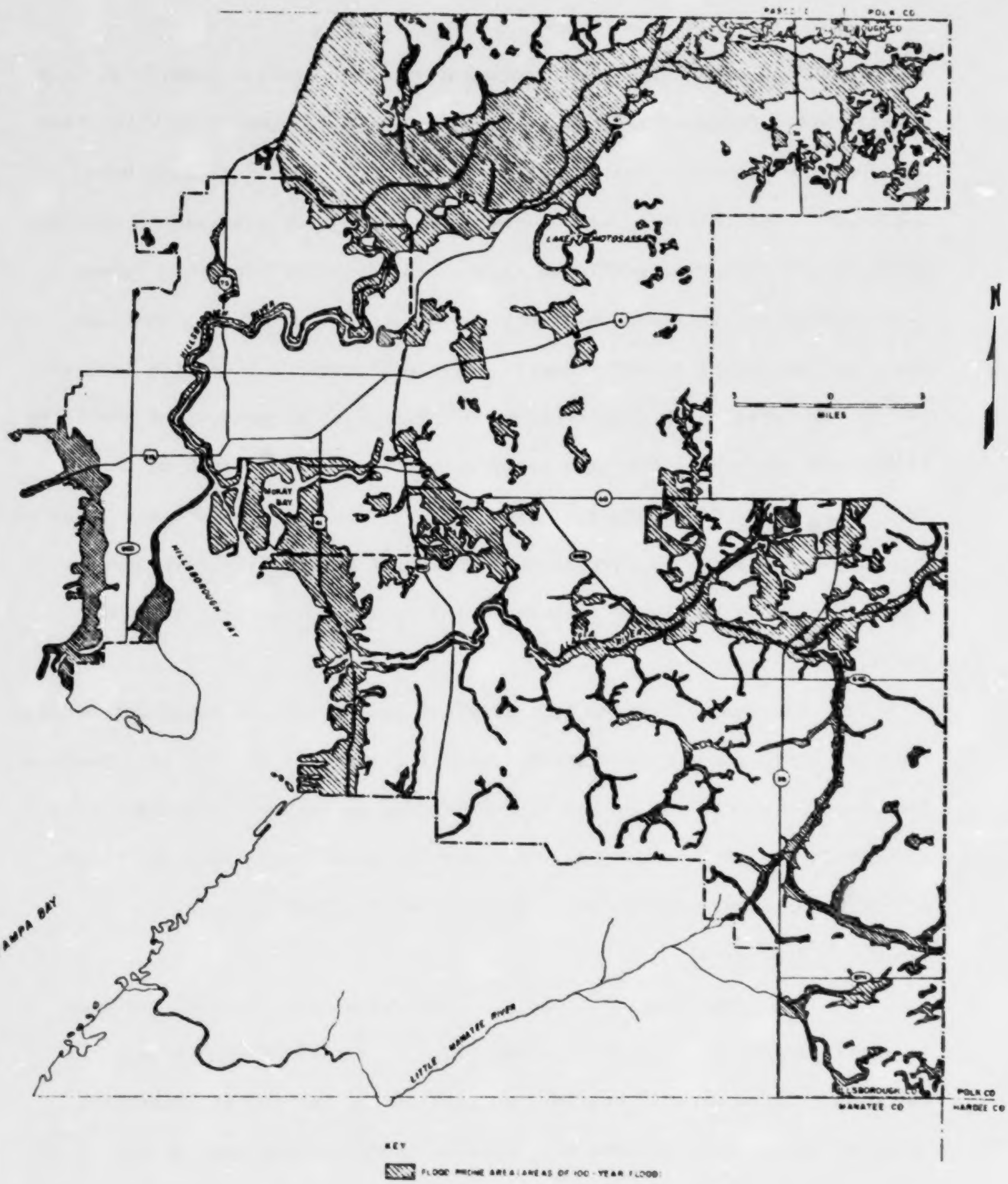
The following sections describe the general characteristics of the wetlands in the Planning Area. In 1980, Dames & Moore prepared an assessment of wetlands in portions of the Deltona Study Area and the Northeast Sector Study Area for the City of Tampa/Hillsborough County. The purpose of the study was to assess the indirect impacts of sewering areas that contain large areas of wetlands generally unaffected by societal development. The results of this study are presented in Appendix A of this Technical Reference Document.

I.5.1 Physical and Chemical

The upstream reaches of rivers in the Planning Area are generally swampy or marshy. These headwaters are usually ill-defined channels crossing large continuous areas of marshes, wet prairies, swamps or wooded wetlands. Wetlands are characterized by vegetation characteristic of low poorly drained soils where water stands at or above land levels for several months of the year. Slow drainage within these areas contributes water to the river and stream tributaries found in the area. The main channels of these streams are usually well defined, with moderately steep, well vegetated banks of sandy soil.

The rivers, streams and creeks of Hillsborough County empty into McKay, Hillsborough and Tampa Bays. Along these coastal wetlands are productive ecological communities discussed in Section I.5.2. In addition to high productivities, these communities protect the shoreline from excessive erosion. The vegetation constitutes an erosion barrier which has the unique capacity to repair itself after storm damage. Because of extensive coastal development, coastal wetlands within the Planning Area have been reduced in acreage and severely altered during recent years. Salt marsh and mangrove communities within Tampa Bay have been estimated to cover approximately 13,900 acres. This acreage represents a 44 percent decline in wetlands within Tampa Bay since 1876 (Lewis, 1976). Additional studies within McKay Bay (Lewis and Courser, 1972) have shown a 65 percent reduction in mangrove and tidal marsh acreage between 1960 and 1972. Significant portions of the Planning Area are subject to flooding during periods of heavy rainfall associated with storms. These flood prone areas have been mapped by H.U.D. and are identified in Figure I.5-1. The major flood prone areas are along the Hillsborough, Alafia and Little Manatee Rivers and along the coastal zone of Hillsborough and Tampa Bays.

To protect flood prone areas and to assist drainage of potential agricultural, grazing, and urban lands, many artificial drainage features


PASCO CO
POLK CO
HILLSBOROUGH CO
LAKE THONOTOSASSA
HILLSBOROUGH RIVER
MCKAY BAY
HILLSBOROUGH BAY
TAMPA BAY
LITTLE MANATEE RIVER
N
MILES
HILLSBOROUGH CO
POLK CO
MANATEE CO
HARDEE CO
KEY
▨ FLOOD PRONE AREA (AREAS OF 100-YEAR FLOOD)

SOURCES: U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
FEDERAL INSURANCE ADMINISTRATION, 1977a, 1977c

CENTRAL HILLSBOROUGH COUNTY-TAMPA
201 FACILITY PLAN
ENVIRONMENTAL REPORT
EPA No. C120634010

FLOOD PRONE AREAS
CENTRAL HILLSBOROUGH COUNTY - TAMPA PLANNING AREA

DAMES & MOORE

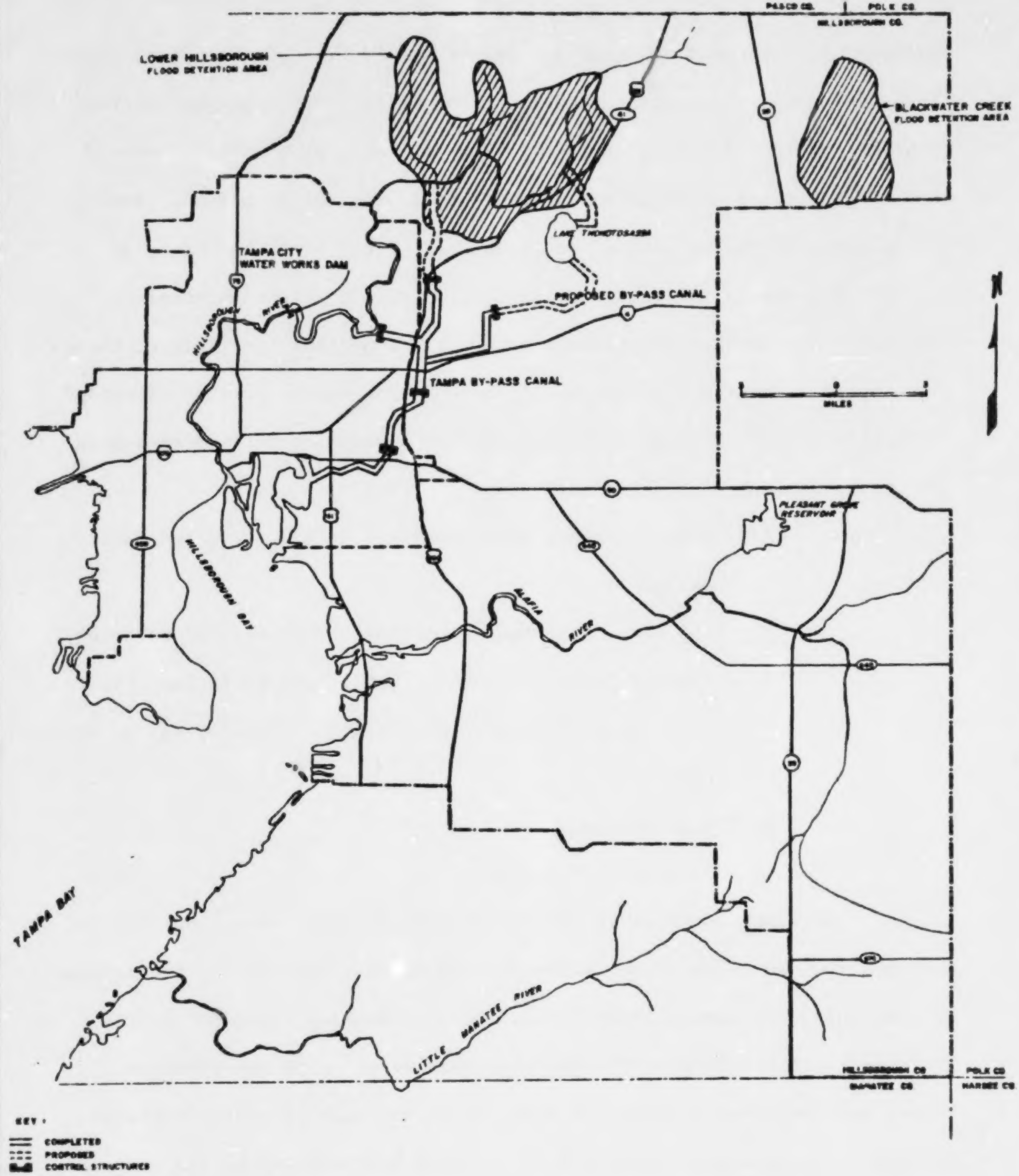
FIGURE I.5-1

and impounding areas have been developed over the years. Manmade surface water control features (Figure I.5-2) often permit movement of water from one drainage basin to another basin. Flood detention areas have been designed to retain water which accumulates during the wet season, thereby, protecting flood prone developed areas. In addition, the Tampa Bypass Canal system was designed to divert flood waters from the Hillsborough River to the waters of McKay Bay. The Tampa Bypass Canal system is partially completed, with construction, or planned construction, of remaining links well underway. During a heavy rainstorm (up to 17 inches) in May 1979, the Harney Canal diverted flood waters from the Hillsborough River to the Tampa Bypass system preventing flooding on the heavily developed floodplain along the lower reaches of the Hillsborough River (SWFWMD, 1979).

In summary, the wetland areas of the county are important because they: 1) store storm waters and moderate the flooding effects of rainstorms; 2) allow the removal of potentially polluting nutrients and sediment and; 3) provide a significant source of water to streams and lakes which are utilized for water supply and recreation in the Planning Area.

I.5.2 Biological

a. Introduction: The most ecologically productive and biologically sensitive vegetation communities in the Planning Area are the wetlands. These natural systems, as part of the land/water interface, occur on low, poorly drained soil that is inundated for much or all of the year, on a "perched" water table, or along the flat intertidal zone. These conditions usually prevail for sufficient time to allow the formation of hydric soils and a characteristic growth of aquatic macrophytes (or


PASCO CO.
POLK CO.
HILLSBOROUGH CO.
LOWER HILLSBOROUGH
FLOOD DETENTION AREA
BLACKWATER CREEK
FLOOD DETENTION AREA
LAKE THONOTOSASSA
TAMPA CITY
WATER WORKS DAM
HILLSBOROUGH RIVER
PROPOSED BY-PASS CANAL
TAMPA BY-PASS CANAL
N
MILES
HILLSBOROUGH BAY
PLEASANT GROVE
RESERVOIR
ALAFIA RIVER
TAMPA BAY
LITTLE MANATEE RIVER
HILLSBOROUGH CO
POLK CO
MANATEE CO
HARDEE CO
KEY:
COMPLETED
PROPOSED
CONTROL STRUCTURES

SOURCES:
WEST COAST REGIONAL WATER SUPPLY AUTHORITY REPORT, 1976
TAMPA BAY REGIONAL PLANNING COUNSEL, 1976a
CORPS OF ENGINEERS, 1977b

CENTRAL HILLSBOROUGH COUNTY-TAMPA
201 FACILITY PLAN
ENVIRONMENTAL REPORT
EPA No. C120634010

LOCATION OF MAJOR SURFACE WATER CONTROLS AND
ARTIFICIAL DRAINAGE NETWORKS

DAMES & MOORE

FIGURE I.5-2

hydrophytes). Wetland habitats are characterized by high biological productivity and perform important functions concerning water storage, aquifer recharge, and removal of pollutants. Stream, lake, or pond edges should also be considered an important part of the land/water interface. Aquatic macrophytes, characteristic of wetlands, also occur along the edges of aquatic habitats in sufficient quantity to create distinct vegetative zonation and a productive littoral zone. The importance and role of these macrophytes along the streams in Hillsborough County are further discussed in Section I.6.2. This section discusses the following wetland or vegetation types present in the Planning Area:

1. The intertidal zone comprised of mangroves and salt marsh.
2. The riverine forest comprised of cypress and hardwood forests, the latter being subdivided to include the more terrestrial bayheads, mixed hardwoods, and mesic hammocks.
3. Cypress domes.
4. Freshwater marshes.

Although portions of the riverine forest are not wetland habitat, they are inclued in the descriptive portion of this section for the purpose of continuity and because these areas are an essential component of the overall riverine habitat. The wetlands that do occur in the riverine forest are indicated in Figure I.4-14, which includes saltwater forested wetland (cypress domes, cypress forest, mixed hardwood swamps and hardwood swamps).

b. Flora of The Wetlands And Land/Water Interface: Mangrove Swamps - Mangrove Swamps are most common in the intertidal zone, but are also found from below the lowest tide levels to as high as the limit of storm tides. Although characteristic of brackish or saline waters, this community may also occur in fresh water portions of rivers. Mangroves are found on flat or nearly flat land surfaces that are only a few feet above sea level. The plants are typically adapted to fixation in loose wet soils, a dominantly saline habitat, and periodic submergence by tides. Their fruits and seeds exhibit different degrees of vivipary (germination while still attached to parent plant) and they also possess other unique adaptations for estuarine habitats, such as respiratory roots (Davis, 1940). An important function provided by mangroves is the protection of extensive shoreline areas from erosion. Additionally, these communities provide food and breeding areas for birds and other wildlife (USDA, 1958).

A number of factors are responsible for making mangrove swamps one of the most productive systems in the world. This high productivity is in part dependent on the presence of lowered salinities, shallow bottoms and high levels of detritus (Lewis and Courser, 1972). The mangrove swamps also serve as traps for detritus and litter materials that are transported by tidal action. In addition, mangroves serve as an energy source for nitrogen fixation (Zuberer and Silver, 1978).

Within the Planning Area, mangrove swamps are located primarily in coastal areas south of the Alafia River, around Bullfrog Creek, along Mckay Bay near the mouth of Palm River and on MacDill Air Force Base (Figure I.4-14. Other small areas where mangrove species still occur include the west side of Hillsborough Bay south of Ballast Point and along canals on the western portion of the Interbay Peninsula. Such areas, although too small to map, may be important in providing remnant pockets of biologically productive habitat in an area otherwise devoid of significant productivity. Mangrove areas of significant size also still occur on the tip of the Interbay Peninsula, although these are not in the Planning Area. Total acreage of mangroves and associated species bordering Tampa Bay has been estimated at approximately 17,500 acre (Simon, 1974).

Mangroves reduce the flow velocity of water resulting in sediment deposition. As the deposition of sediment continues, more xeric communities, dominated by plants such as buttonwood, slowly replace these mangrove stands. Disturbances, such as hurricanes, reverse the successional trend by destroying large tracts of mangroves and removing the accumulated sediments. Eventually, these areas will be reinvaded by mangroves and the successional trend to a more xeric community will continue (U.S. Army Corps of Engineers, 1978). Carlton (1974) believes the successional development of mangrove communities plays an important role in the process of land building in south Florida.

The soils layers of mangrove swamps vary in color, texture, composition and thickness. The surface layer is generally sand, mixed with muck or peat that has accumulated from decaying leaves, limbs and roots of dead mangrove trees. Immediately below the surface layer is fine light-gray or gray sand or sandy clay loam. In a few places, moderately hard limestone occurs within 30 inches of the surface (USDA, 1958).

Mangroves and associated species comprise a number of distinct zones or belts of vegetation that are related to water level and salinity of the surface and soil water. The red, black and white mangroves characterize these saltwater swamps of Florida. Buttonwood or button mangrove is often found in association with these three species (Carlton, 1974). Red mangrove typically dominates the wettest portions of the swamps, while black mangroves usually gain importance in shallower areas, particularly those inundated only at high tide. White mangrove is usually found in mixture with both red and black mangroves, although this species is usually absent from the wettest portions of the swamp and is most common inland of black mangrove stands.

Studies within McKay Bay have shown that white mangroves are most common, black mangrove is less common and red mangroves are least common. The abundance of white mangroves has been attributed to the quick recovery of this species on disturbed land and spoil areas which typify the region (Lewis and Courser, 1972).

Areas not completely covered by mangroves are often dominated by halophytic and/or succulent plants characteristic of salt marshes. Between the mangrove swamps and salt marshes, a transitional community composed of stunted white mangroves, salt grass and black needlerush is often found. Where the swamps open directly upon marsh communities, typical species may include saltwort, Bigelow's glasswort, sea blite and sea purslane. Less frequently the mangrove swamps may border a more upland habitat type. In this habitat, salt tolerant herbs such as sea daisies, prickly pear, marsh elder and bay cedar may be present (U.S. Army Corps of Engineers, 1978). Observations within mangrove swamps along the shoreline of McKay Bay have recorded black needlerush as the most common marsh plant with small stands of cord grass off shore (Lewis and Courser, 1972).

Salt Marshes - Although the primary intertidal vegetation type occurring in Tampa and Hillsborough Bay is mangrove swamp there also remains a substantial intertidal marsh community. These communities may be found adjacent to, or in close proximity with the mangrove swamps, although shading effects by the mangroves limit extensive growth of salt-marsh species beneath the canopy.

The most conspicuous intertidal communities (mangrove and salt marshes) occur along the eatern shores of Tampa and Hillsborough Bays (Figure I.4-14). Within Tampa Bay, salt marshes have been estimated to cover approximately 1700 acres of shoreline (Simon, 1974). As with the mangrove swamps, areas of saltmarsh vegetation, too small to be mapped, intermittently occur throughout the bay area and provide important biological functions.

Most indigenous plants cannot survive salinities approaching pure sea water. These plants are replaced in the salt marsh by a few species with high salinity tolerance, or halophytes. Included in this group are smooth cordgrass, needle rush, glasswort and sea oxeye (Georgia Department of Natural Resources, 1975). Other species commonly found in the area are salt grass and beach carpet. These two species occur primarily in monospecific stands at the edges of mangrove swamps, along shorelines and at the mouths of major river systems. Portions of creek banks exposed during periods of low tide are usually devoid of vegetation. Areas of higher elevation and generally lower salinities are characterized by a shrubby growth of tidal bush, groundsel tree and occasional cabbage palmetto.

Cypress Forest - Bald cypress stands are common in the riverine areas of Hillsborough County. Pure stands are usually even aged as a result of clearing and subsequent succession from a single or a few seedlings. Most individuals are small averaging less than 60 cm. in diameter above the buttressed base (Cowel, et al., 1974). Cypress stands usually appear as a dense single layer canopy with straight unbranched trunks rising from bare ground or permanent water. All cypress forest areas have some hardwood trees, including red maple, sweet gum, water hickory and blue beech. The understory is often comprised of buttonbush, Florida privet, and dogwood (Cowell, et al., 1976). Ferns, such as the royal fern, sedges, grasses, smartweed and pennywort are common within the herbaceous layer.

Hardwood Forest - Within the hardwood forest vegetation type, periodic inundation is characteristic with standing water persisting in many areas throughout the year. This riverine forest type follows the drainage patterns of the major river systems in the Planning Area. Streams and creeks in the southern portion are predominantly lined with hardwood forest. In the northern portion, along the Hillsborough River, the hardwood forest vegetation type is particularly rich and extensive. Here, the mixed hardwood swamp is prevalent with bald cypress being the conifer species. These bottomlands are relatively undisturbed and offer wildlife an important refuge. Many of the protected plants listed in Table I.4-3 are also found in these swamps.

This forest community also contains bayheads, which are dominated by low, much-branched trees (e.g., redbay, sweetbay and loblolly bay). Shrubs in this habitat include gallberry, fetter bush and wax myrtle. Many portions of these swamps may be termed mixed hardwood swamps due to the presence of cypress, southern red cedar and cabbage palm. Most of the trees in mixed hardwood swamps are deciduous while the bayhead supports predominantly evergreen species.

The forest floor is characterized by depressions interspersed with raised hummocks formed from expansive root development. The more mesic herbaceous species occupy the drier hummocks and muck/peat soils support hydrophytic emergent species within the hollows. Dominant overstory trees throughout much of the hardwood swamp are sweet gum, red maple, black gum, ash, elm, water and laurel oaks. Understory vegetation is often composed of Florida privet, wax myrtle, buttonbush, dogwood, gallberry, hawthorn and chickasaw plum. Herbaceous species are numerous, although not as dense as in the marshes due to shading from overstory vegetation. Ferns and hydrophytic species are predominant and epiphytic bromeliads are also present. Resurrection fern grows ubiquitously on branches and trunks and is apparently not a host specific epiphyte (Cowell, et al., 1976). Commonly found vines are grapes, Virginia creeper, peppervine and trumpet creeper.

Mesic areas within the hardwood forest are dominated by live oak, water oak, willow oak and sweetgum. Slash pine also occasionally occurs in this "mesophytic" community. Saw palmetto becomes the dominant understory species. Feral pig populations remain significantly large in these mesic hammocks so that considerable damage to understory and herbaceous growth is often evident (Cowell, et al., 1976).

Cypress Dome - The name "dome" originates from the symmetrically convex silhouette of the isolated cypress stands that grow on beds of acid sand and clay. A cypress dome usually consists of moist soil or a central pond of water where the tallest cypress trees grow. These tall cypress are surrounded by a peripheral fringe of smaller trees. Cypress domes or cypress heads constitute a relatively small percentage of the Planning Area's total forest type, but are an important successional link between the flatwoods and the climax hardwood hammock (Laessle, 1942). Unlike the surrounding pine flatwoods, which are believed to be a fire sub-climax (Edmisten, 1963), cypress heads are probably a result of edaphic conditions (Monk and Brown, 1965).

The sloping profile of a cypress dome may result from a combination of factors, including soil characteristics (hydroperiod, nutrient constant, acidity, organic matter and clay content) that vary in relation to the distance from the center of the dome and account for the decreased height of cypress towards the edge of the dome. The profiles of cypress domes are additionally influenced by fire and domesticated livestock (Kurz and Wagner, 1953). Kurz and Demaree (1934), studying the formation and shape of cypress buttresses, postulated that their shape was determined by periods of inundation. They proposed that the longer the trunk was under water, the greater its basal flare would be. Bald cypress is known to grow in more alkaline soil than pond cypress (Monk and Brown, 1965; Laessle, 1942).

Because of its durability, cypress lumber has always been in demand for fence posts and other utility items. Between the years 1929 and 1939, nearly 300 million board feet of cypress and hardwoods were cut annualy in Florida. Up to 1942, over 150 million board feet of these two timber types were still cut each year (Florida State Department of Education, 1946). More recently, extensive ditching, draining and clearing operations have been responsible for eliminating many cypress dome areas. The demand for more forested land for pulp and paper production, pasture and urban development has resulted in drastic changes in the area's ecology. The drying of cypress domes has resulted in the invasion of the more profitable slash pine where deep water once excluded it (Edmisten, 1963).

Bald cypress domes are very abundant in the northern half of the Planning Area but sparse in the south. Some domes have pockets of associated hardwood species (sweet gum, red maple and black gum), but usually the overstory is completely dominated by bald cypress. Standing water provides habitat for a dense growth of coontail, duckweed, water starwort, pickerel weed and other aquatic plants. The understory vegetation is clumped around the stems, stumps or on the knees of the cypress. Wax myrtle is often predominant along the periphery of the domes and other plants include several ferns, flag plant and groundsel tree.

Undisturbed cypress domes may provide a useful water conservation measure. For example, in Naples, Florida, cypress sloughs have been preserved resulting in less drain on the water table and it has been much less than if cypress were not present. Cypress ponds also may serve to conserve water by allowing the water in their pools to percolate slowly into the ground water when rainfall is low (Wharton, et al., 1977).

Freshwater Marsh - This wetland type occurs throughout the Planning Area with the majority of marshes dotting the northern half of the Area (Figure I.4-14). Many of these marshes, like cypress domes, are too small to depict on the wetlands map. Nevertheless, these areas have a high habitat value. The edge-effect further enhances their importance to wildlife.

Within the freshwater marsh vegetation type, water flows into depressions carrying organic and inorganic materials which are incorporated into the plant biomass or deposited in bottom sediments. Water loss occurs through surface evaporation, seepage and transpiration. At the same time, organic and inorganic material accumulate and gradually fill in the depression.

Soils of the freshwater marsh are normally covered with a few inches of water throughout the wet season and remain wet throughout the rest of the year. Old field and freshwater marsh vegetation species are somewhat similar, with the hydroperiod (time regime of high and low water conditions) distinguishing the two vegetation types. The freshwater marsh is composed predominantly of succulent plant species whose roots are almost continuously submerged. During the dry season, the freshwater marsh remains wet because:

1. Its relatively low topographic position results in a higher water table,
2. Its organic soils have a high, water holding capacity, and/or
3. It has a perched water table (Pool, 1973).

Freshwater marshes are characterized by standing water during most of the growing season. All species in marshes are stressed by water level fluctuations. Many species of aquatic vascular plants, such as pickerelweed, water hyacinth and water lettuce, are poorly adapted to low water levels. Hence, these species are generally found in the deeper, central portions of the marshes. Species more tolerant to fluctuating water levels occur along the periphery and include the emergent species, such as cattail, cut grass, reed and bulrush. Common throughout these marshes are pickerelweed, smartweed, reed, maidencane, arrowhead and numerous other hydrophytic species.

Many concepts have been proposed concerning aquatic plant succession in southern marshlands. Zonation of plants in response to water depth from the shore outward was suggested by Wells (1942). Weaver and others (1938) suggested several seral stages important in aquatic plant succession: submerged, floating, reed-swamp, sedge-meadow and woodland (alder, willow, maple, etc.). Submerged, floating-leaved and sedge-meadow stages are usually absent wherever perennial floating mats can develop. In the southern coastal states, water hyacinth plays a predominant role in fresh water by providing a floating platform upon which numerous other plants become established. After about 25 years, the mat is transformed into a floatant comprising one or more of the following species: cattail, cut grass, giant bulrush, maidencane, saw grass and water fern (Penfound and Earle, 1948). The constant supply of moisture in this marsh reduces competition for available water.

c. Fauna of Wedland and The Land/Water Interface: Members of all of the vertebrate groups are found in wetland habitats, but the amphibians and birds are particularly abundant. Nearly all species of amphibians require standing water for breeding purposes and are thus permanently linked to wetland situations. The Planning Area has a large and diverse avifauna, including many migratory species of water fowl and shore birds which require the abundant wetland areas as wintering grounds.

Table I.5-1 provides a listing of the vertebrate fauna associated with the various types of wetlands in the Planning Area. All of the amphibian species listed require water for breeding. Some species, particularly the toads, spend the majority of their life cycle in terrestrial situations and are linked to water only for reproduction. However,

TABLE I.5-1

FAUNA OF WETLANDS AND LAND-WATER INTERFACES

Common Name	Preferred Habitat	Conservation Status/ Comments
Amphibians and Reptiles		
American Alligator	All wetland types, rivers, lakes, ponds, marshes and canals.	Special concern
Florida Snapping Turtle	Any freshwater or brackish water.	
Suwannee Cooter	Clear water springs.	Threatened
Peninsula Cooter	Lakes, sloughs, wet prairies and canals.	
Florida Red-Bellied Turtle	Streams, ponds, lakes, marshes, ditches and mangrove lines and creeks.	
Florida Chicken Turtle	Still water ponds, marshes and ditches.	Often on land
Striped Mud Turtle	Deep drainage canals, sloughs, wet prairie and pasture.	Often forages on land
Florida Mud Turtle	Drainage ditches, marshes, sloughs and ponds.	
Ornate Diamondback Terrapin	Brackish marshes and embayments.	Often in mangroves
Stinkpot	Shallow clearwater lakes, ponds and rivers.	
Florida Softshell	Canals, ponds, lakes and big springs.	One of most conspicuous species popular food item, thus economically significant
Two-Toed Amphiuma	Ditches, ponds, swamps and marshes.	Highly aquatic
Southern Dusky Salamander	Cypress ponds.	Prefers acidic waters

(Continued)

TABLE I.5-1 (Continued)

Common Name	Preferred Habitat	Conservation Status/ Comments
Amphibians and Reptiles		
Florida Newt	Ponds, ditches and swamps.	Hyacinths associated, ecologically significant
Dwarf Salamander	Low wet swamps.	Ecologically significant
Peninsula Newt	Ponds, ditches and swamps.	Hyacinths associated, ecologically significant
Slimy Salamander	Woodlands and ravines.	Skin gland secretions
Dwarf Siren	Marshes and ponds.	Prefers hyacinths
Eastern Lesser Siren	Weed choked cannals and ponds.	
Greater Siren	Shallow water ditches and ponds.	
Southern Cricket Frog	Riverine Floodplains.	
Giant Toad	Cosmopolitan.	Introduced, significant ecologically
Oak Toad	Pinewoods and hammocks	
Southern Toad	Sandy well drained old field.	Chiefly nocturnal
Greenhouse Frog	Gardens, hammocks and stream floodplains	Introduced
Eastern Narrow-Mouted Toad	Varied.	Seeks moisture and shelter
Green Tree Frog	Swamps, lakes and residential yards.	
Pine Woods Treefrog	Pine flatwoods and cypress swamps.	Arboreal
Barking Treefrog	Varied and shrubs.	Climber and burrower

(Continued)

TABLE I.5-1 (Continued)

Common Name	Preferred Habitat	Conservation Status/ Comments
Amphibians and Reptiles		
Squirrel Treefrog	Varied and cosmopolitan.	
Little Grass Frog	Ponds and cypress bays.	Elfin frog
Florida Chorus Frog	Varied, ponds, ditches, and flatwoods.	
Ornate Chorus Frog	Cypress ponds and wet prairie.	
Florida Gopher Frog	Coastal hammocks and dry ridges.	Threatened, most often associated with Gopher Tortoise
Bullfrog	Open water bodies, lakes, ponds and marshes.	Economically significant
Pig Frog	Quiet fringes of marshes and lakes.	Economically significant
Southern Leopard Frog	Shallow freshwater areas and some brackish.	
Eastern Spadefoot Toad	Sandy ridges and croplands.	Ecologically significant
Eastern Cottonmouth	Swamps, lakes, rivers and moist pine flatwoods.	Poisonous
Mangrove Watersnake	Salt and brackish water and mangrove swamps.	
Mud Snake	Swamps and marshes.	Burrowing, also swimmer
Striped Swamp Snake	Shallow water with dense vegetation canals and ponds.	Prefers hyacinths
Florida Green Watersnake	Swamps, marshes, quiet lakes and ponds.	Occasionally in brackish waters
Florida Watersnake	Shallow water habitats, swamps and marshes	Ecologically significant
Brown Watersnake	Clear and quiet waters.	Swimmer and tree climber

(Continued)

TABLE I.5-1 (Continued)

Common Name	Preferred Habitat	Conservation Status/ Comments
Amphibians and Reptiles		
Rough Green Snake	Borders of lakes, ponds and in rural residences	"Vine" snake; very thin and climbs
Yellow-Lipped Snake	Damp lowlands, borders of swamps.	
Southern Florida Swamp Snake	Ponds, canals and ditches.	Prefers hyacinths
Florida Brown Snake	Bogs and marshes and upland hammocks.	Active following heavy rains
Birds		
Yellow-Crowned Night Heron	9/W	SC
Eastern Least Bittern	3,10/WBT	SC
American Bittern	3, WT	BL
Wood Ibis	3,9,10/W	E
Glossy Ibis	9, 10	ES
White Ibis	1,3,9,10/BW	SC
Roseate Spoonbill	9/W	T
Blue Goose	9/WT	Game
Mallard	3,4,10/WT	Game
Black Duck	9/W	Game
Florida Duck	9,10/WT	Game
Gadwall	9,10/WT	Game
Pintail	9,10/WT	Game
Green-Winged Teal	9,10/WT	Game
Blue-Winged Teal	9,10/WT	Game

(Continued)

TABLE I.5-1 (Continued)

Common Name	Preferred Habitat	Conservation Status/ Comments
Birds		
European Wigeon	4,9,10/WT	Game
American Wigeon	4,9,10/WT	Game
Northern Shoveler	3,4,9,10/WT	Game
Wood Duck	1,3,4/BW	Game
Redhead	9,10/WT	Game
Mottled Duck	9,10/BW	Game
Ring-Necked Duck	3,4,9/WT	Game
Canvasback	9/W	BL/Game
Lesser Scaup	3,9,10/WT	Game
Bufflehead	9/WT	Game
Oldsquaw	9/WT	Game
Ruddy Duck	9/W	Game
Hooded Merganser	3,10/W	Game
Red-Breasted Merganser	9/W	Game
Sharp-Shinned Hawk	1,2,10/WB	BL, ES
Cooper's Hawk	1,2,10/WB	BL, SC
Southern Bald Eagle	1,2,9,10/W(B)	TH
Marsh Hawk	1,3,10/W	BL, ES
Osprey	1,3,4,9,10/BW	BL, TH
White-Tailed Kite	3,7,8/T	R
Florida Sandhill Crane	2,7,8,11/BW	TH
Limpkin	1,3,4,10/WB	ES

(Continued)

TABLE I.5-1 (Continued)

Common Name	Preferred Habitat	Conservation Status/ Comments
Birds		
King Rail	3,10/BT	BL, Game
Clapper Rail	9/W	Game
Virginia Rail	3,10/W	Game
Sora	3,10/W	Game
Black Rail	9/WB	SU
Common Gallinule	3,10/BW	Game
American Coot	3,9,10/W	Game
Purple Gallinule	1,10,3/WB	ES
American Oystercatcher	9/WB	BL, TH
Semipalmated Plover	9/WB	
Piping Plover	9/W	BL, SC
Snowy Plover	9/WB	BL, E
Wilson's Plover	9/W	
Black-Bellied Plover	9/WT	
Ruddy Turnstone	9/WT	
American Woodcock	1,10/W	Game
Common Snipe	3,10/W	Game
Long-Billed Curlew	9/T	
Whimbrel	9/T	Accidental (European)
Spotted Sandpiper	9/WB	
Solitary Sandpiper	9/W	

(Continued)

TABLE I.5-1 (Continued)

Common Name	Preferred Habitat	Conservation Status/ Comments
Birds		
Willett	9/W	
Greater Yellowlegs	9/W	
Lesser Yellowlegs	9/T	
Red Knot	9/T	
Pectoral Sandpiper	9/T	
White Rumped Sandpiper	9/T	
Least Sandpiper	9/W	
Dunlin	9/T	
Long-Billed Dowitcher	9/W	
Short-Billed Dowitcher	9/W	
Stilt Sandpiper	9/T	
Semipalmated Sandpiper	9/W	
Western Sandpiper	9/W	
Marbled Godwit	9/W	
Sanderling	9/T	
American Avocet	9/T	SC
Black-Necked Stilt	9/WB	
Wilson's Phalarope	9/T	
Northern Phalarope	9/T	
Great Black-Backed Gull	9/W	
Lesser Black-Backed Gull	9/W	

(Continued)

TABLE I .5-1 (Continued)

Common Name	Preferred Habitat	Conservation Status/ Comments
Birds		
Herring Gull	9/W	
Ring-Billed Gull	9/T	
Black-Headed Gull	9/T	European
Laughing Gull	9/W	
Bonaparte's Gull	9/T	
Forster's Tern	9/WB	
Common Tern	9/W	
Royal Tern	9/W	SC
Sandwich Tern	9/W	SC
Caspian Tern	9/W	
Black Skimmer	9/BW	SC
Least Tern	9/W	BL, TH
Black Tern	9/T	
Common Loon	9/W	
Horned Grebe	9/W	
Pied-Billed Grebe	10/W	
Brown Pelican	9/BW	T
Yellow-Billed Cuckoo	9,10/TB	BL
Smooth-Billed Ani	3/T	
Belted Kingfisher	1,10/BW	
Gray Kingbird	9/BW	
Rough-Winged Swallow	5,10/T	

(Continued)

TABLE I.5-1 (Continued)

Common Name	Preferred Habitat	Conservation Status/ Comments
Birds		
Long-Billed Marsh Wren	3,11/W	
Short-Billed Marsh Wren	3,11/W	
Red-Winged Blackbird	3,4,6,10/WB	
Mammals		
Seminole Bat	Swamps and hammocks.	
Florida Water Rat	Marshes and wet prairie.	Protected fur bearer; special concern
Rice Rat	Wet prairie and marshes.	Nocturnal, semi-aquatic
Eastern Woodrat	Hammocks, swamps and cabbage palmetto	Uncommon
Cotton Mouse	Swamps and hammocks.	Tree climbing
Marsh Rabbit	Hammocks, swamps and marshes.	Chiefly nocturnal, game species
River Otter	Swamps, hammocks and lake fringes.	Highly aquatic fur bearer; very active
Mink	Swamps, lake fringes.	Rare

(Continued)

TABLE I.5-1 (Continued)

Common Name	Preferred Habitat	Conservation Status/ Comments
Mammals		
Raccoon	Hammocks and swamps.	Omnivorous, prefers streams; fur bearer
Nutria	Marshes and swamps	Introduced.

3 = Cypress dome for freshwater marshes
9 = River, bay (or estuary)
10 = Freshwater (ponds, canals and ditches)

BL = "Blue Listed"
E = Endangered
TH = Threatened
R = Rare
SC = Species of Special Concern
ES = Ecologically Significant
G = Game Species
W = Wintering
B = Breeding
T = Transiety

most of the amphibians spend nearly all of their life cycle in wetlands or landwater interface habitats. The southern leopard frog is the only amphibian species listed which is often found in brackish situations; the other amphibians are generally limited to freshwater wetlands.

At least 22 species of reptiles require wetlands habitats. These are nearly equally divided between turtles and snakes. Three species, the Florida snapping turtle, the diamondback terrapin, and the mangrove water snake are often found in the brackish water areas of mangrove swamps and salt marshes. The other 19 species are distributed among the various freshwater habitats.

The most conspicuous and diverse residents of wetlands and landwater interface habitats are the birds. All of the wetland habitats in the Planning Area are used by bird species, including many species of shorebirds which winter in the Area. As the large number of species in Table I.5-1 indicates, these wetlands are an extremely valuable bird wintering ground. Since many of these species are shorebirds, the land-water interface habitats are of particular importance. As more of these areas undergo development, much of this habitat could potentially be lost to the birds.

Ten species of mammals are common residents of wetland areas. None of these animals require brackish water wetlands but some, such as the raccoon and nutria can use these areas.

Wetlands provide habitat for many threatened and endangered species. All of the threatened and endangered species listed in Table I.5-1 require wetlands habitats. Through conscientious management practices some of these species are making a return, the American Alligator being the best known example. Also, within the last five years, both redish egrets (Paul, Meyerriecks, and Dunstan, 1975) and roseate spoonbills (Dunstan 1976) have returned as breeding birds in the Planning Area. Proper management of wetlands areas will be necessary for the continued recovery of these and other threatened and endgangered species.

I.6 WATER

Population, vegetation and wildlife, as well as industrial development, depend on water resources. This section describes these resources in the Planning Area.

I.6.1 Physical and Chemical

a. General: The water cycle is the continuous circulation of moisture and water on our planet, the stages of which include precipitation, percolation, runoff and evaporation.

There are two primary sources of water supply available to man: surface sources, which include lakes, streams and reservoirs and ground sources, which include wells and springs. Ground and surface water sources do not always function as independent systems. The water supply of the Planning Area utilizes both ground and surface water sources to meet the needs of the population.

The two major rivers in the Planning Area, the Hillsborough River and the Alafia River, are both fed by springs. Hillsborough River, the main source of drinking water for the City of Tampa, receives a considerable portion of its flow during the dry season from ground water inflow. Rivers, ponds and lake levels are also maintained and augmented by seepage from the water table aquifer, especially during dry periods. Recharge of the ground water supplies occurs through infiltration of surface waters into the surficial sediments and through sinkholes. Capture of surface water flows and the emergence of the ground water in springs are ways that surface and ground water interact.

Because the pollution of surface or ground waters can directly affect the other source of water supply, an understanding of the ground and surface water interrelationships is necessary to provide means of protecting and preserving the water supplies of the Planning Area.

1. Surface Water: The major surface water systems within the Planning Area include the Tampa/Hillsborough Bay system, the Hillsborough and Alafia River Basins as well as numerous springs and lakes. These items are discussed in greater detail below.

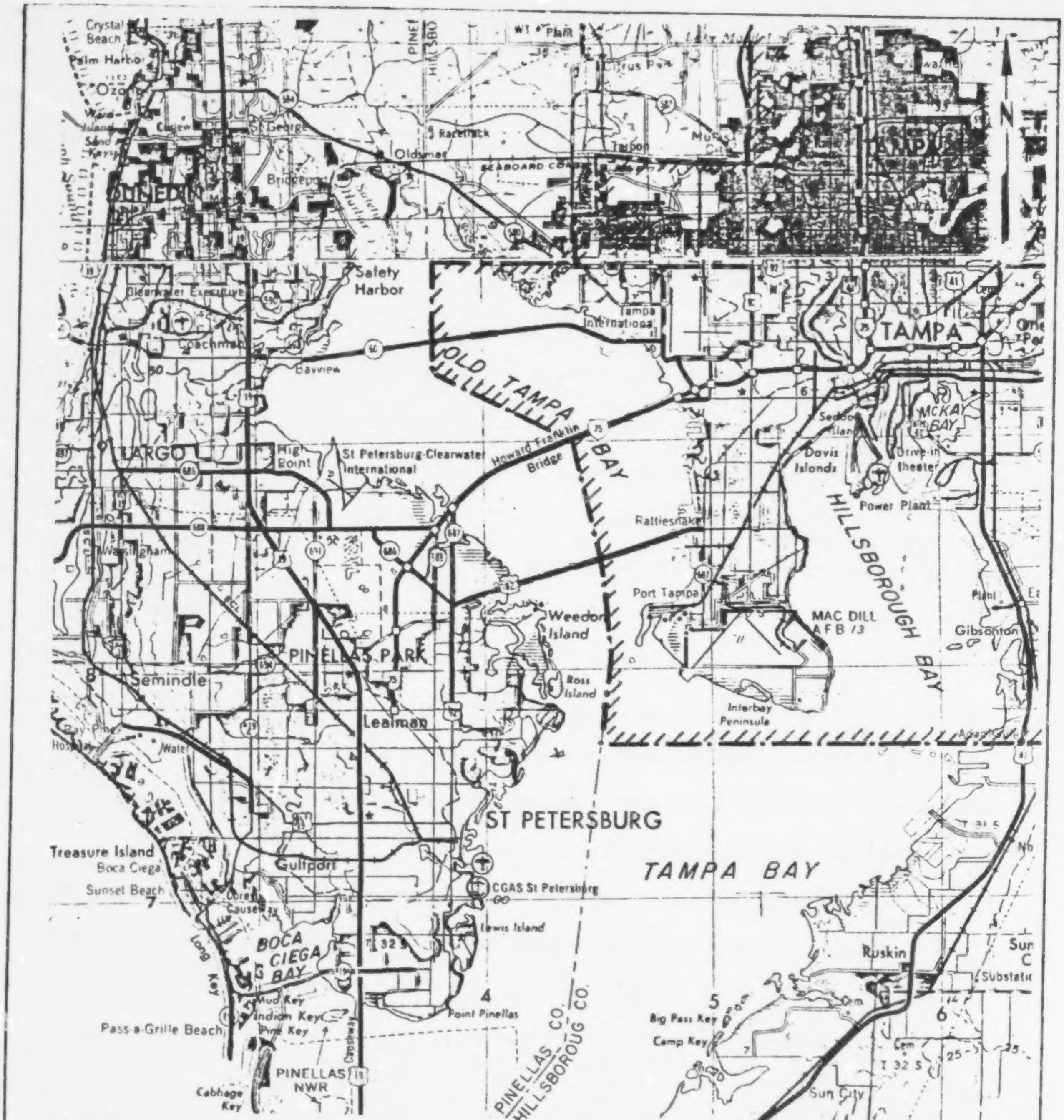
Bays - The Tampa/Hillsborough Bay system is composed of adjoining estuaries which include Boca Ciega Bay, Tampa Bay, Old Tampa Bay, Hillsborough Bay, McKay Bay and Terra Ceia Bay (Texas Instruments, 1978) (Figure I.6-1). The Planning Area includes portions of upper Tampa Bay, the eastern half of Old Tampa Bay and all of Hillsborough and McKay Bays.

Tampa Bay is bordered on the west by the City of St. Petersburg; on the north by Old Tampa Bay, the City of Tampa and Hillsborough Bay; and on the east by the unincorporated areas of Hillsborough and Manatee Counties. Tampa Bay has a surface area of approximately 350 square miles and an average depth of 11 feet.

Hillsborough Bay is bounded on the west and north by the Tampa metropolitan area and on the east by generally undeveloped areas of Hillsborough County. Hillsborough Bay has a surface area of approximately 35 square miles and an average depth of 10 feet.

Old Tampa Bay is bounded on the east by the metropolitan area of Tampa; on the south by Tampa Bay; and on the north and west by largely undeveloped areas of Pinellas and Hillsborough Counties. Old Tampa Bay has a surface area of approximately 70 square miles and an average depth of 9 feet.

McKay Bay is bounded entirely by the metropolitan area of Tampa with the exception of the connection to Hillsborough Bay in the south. McKay Bay has a surface area of approximately 1.5 square miles. The deepest natural parts are only 5 feet deep but dredging of the Tampa Bypass Canal and borrow areas have left areas as deep as 15 feet (Lewis, et al., 1972).


Crystal Beach
Palm Harbor
Ozona
Dunedin
St George
Racetrack
Oldsmar
Bridgeport
Tarpon
Safety Harbor
Clearwater Executive
Coachman
Bayview
OLD TAMPA BAY
Tampa International
TAMPA
Largo
High Point
St Petersburg-Clearwater International
Howard Franklin Bridge
Davis Islands
MCKAY BAY
Drive-in theater
Power Plant
Rattlesnake
HILLSBOROUGH BAY
Walsingham
Port Tampa
Weedon Island
MAC DILL AFB
Gibsonton
PINELLAS PARK
Seminole
Ross Island
Interbay Peninsula
Lealman
ST PETERSBURG
Treasure Island
Boca Ciega
Sunset Beach
Gulfport
Corey Causeway
CGAS St Petersburg
TAMPA BAY
Lewis Island
BOCA CIEGA BAY
Long Key
Ruskin
Mud Key
Indian Key
Pine Key
Point Pinellas
Pass-a-Grille Beach
Big Pass Key
Camp Key
PINELLAS NWR
Cabbage Key
Sun City
PINELLAS CO.
HILLSBOROUG CO.

LEGEND:

▨ CENTRAL HILLSBOROUGH-TAMPA 201 PLANNING AREA BOUNDARY

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1:250,000 MAPS, 1955a, 1956a

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TAMPA BAY SYSTEM

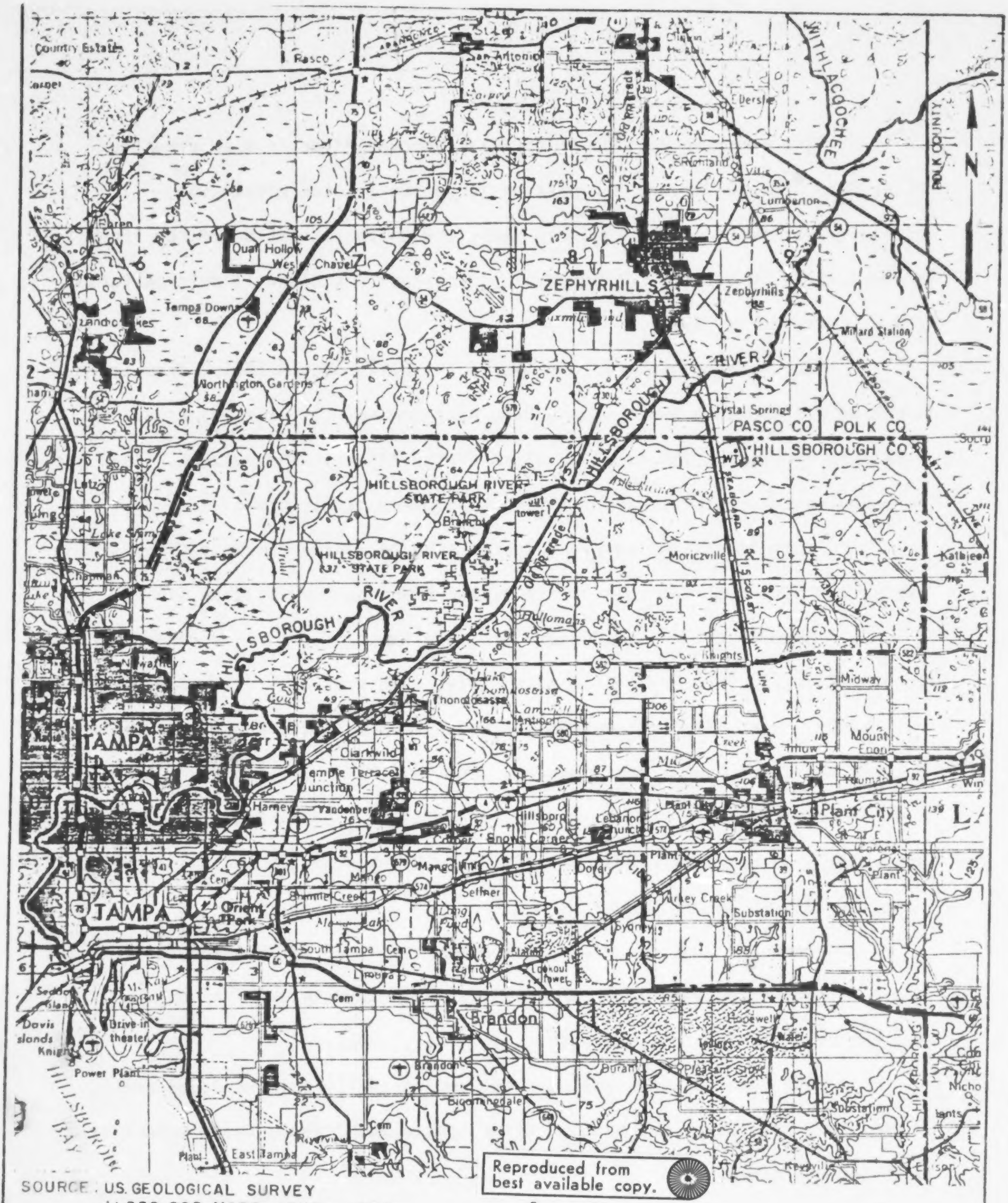
DAMES & MOORE
FIGURE I.6-1

In 1975, the Port of Tampa was ranked the eighth largest port in the United States in terms of tonnage handled. It is the largest phosphate export port in the world (U.S.C.O.E., 1977a). Hookers Point, a natural peninsula extending into Hillsborough Bay, is the site of most of Tampa's heavy industry and port terminals as well as Tampa's municipal wastewater treatment plant. Sulfur, scrap iron and phosphate terminal facilities as well as Tampa's largest steam-electric generating plant are located at Port Sutton, a privately financed port, on the northeastern edge of Hillsborough Bay.

Hillsborough River Basin - The Hillsborough River drains the northern portion of the Planning Area (Figure I.6-2) as well as portions of Hernando, Pasco and Polk Counties. The headwaters of the Hillsborough River are located in the Green Swamp area of central peninsular Florida. During periods of high water, the Withlacoochee River, which drains parts of Lake and Sumter Counties, overflows into the Hillsborough River by way of an overflow channel near Richland. The river flows approximately 54 miles from its headwaters southwestward to Hillsborough Bay (Figure I.6-2).

The total area drained by the Hillsborough River is approximately 690 square miles. Approximately 320 square miles of the total drainage area are located in Hillsborough County. Elevations in the portion of the basin within the county range from sea level near the mouth to 140 feet MSL east of Plant City.

Along the northern portion of the river within Hillsborough County, land use is predominately rural. Approximately 76 percent is agricultural, 11 percent is marsh and swamp, 8 percent is forest and 5 percent is in other uses (Texas Instruments, 1978). Agricultural land is citrus, cattle or truck farms.



Country Estates
Pasco
San Antonio
WITHLACOOCHEE
POLK COUNTY
N
Elberta
Lumberton
Quail Hollow
Wesley Chapel
ZEPHYRHILLS
Zephyrhills
Tampa Downs
Land o' Lakes
Millard Station
RIVER
Northington Gardens
Crystal Springs
PASCO CO
POLK CO
HILLSBOROUGH CO.
HILLSBOROUGH RIVER STATE PARK
HILLSBOROUGH
HILLSBOROUGH RIVER
Moriczville
Kathleen
Lutz
Lake Stem
Chapman
Hollomans
Knights
Midway
Thonotosassa
TAMPA
Clarkwild
Temple Terrace Junction
Harney
Vandenberg
Mount Enon
Youmans
Plant City
Hillsboro
Snows Corner
Lebanon Church
Mango
Seffner
Dover
Turkey Creek
Substation
Orient Park
South Tampa
Limona
Lookout tower
TAMPA
Davis Islands
Drive-in theater
Brandon
Hopewell
Pleasant Grove
Power Plant
HILLSBOROUGH BAY
East Tampa
Bloomingdale
Riverview
Keysville
Substation

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SOURCE: US. GEOLOGICAL SURVEY
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—·—·— CENTRAL HILLSBOROUGH - TAMPA 201 PLANNING AREA BOUNDARY

HILLSBOROUGH RIVER

DAMES & MOORE
FIGURE I.6-2

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The southern portion of the Hillsborough River is more urbanized. Plant City, Temple Terrace and part of Tampa are located within the Hillsborough River basin. Land use along the southern portion of the river is approximately 50 percent agricultural, 30 percent urban and 11 percent forest (Texas Instruments, 1978).

The extreme southern portion of the Hillsborough River, from its mouth at Hillsborough Bay to Tampa Dam, approximately 10 miles upstream, is tidal and brackish. The first 1½ miles of the river is channelized. Land use surrounding this portion of the river is almost entirely urban.

Palm River/Sixmile Creek Basin - The Palm River/Sixmile Creek Basin drains the northwest central portion of the Planning Area (Figure I.4-4).

Sixmile Creek's headwaters are in a low flat prairie southeast of Temple Terrace. The creek flows seven miles in a southerly direction to the Palm River. Much of the creek bed has been altered in the upper reaches as part of the Tampa Bypass Canal system. The Palm River is a continuation of Sixmile Creek and flows approximately two miles in a southwesterly direction to McKay Bay. In total, the Palm River/Sixmile Creek drainage basin encompases approximately 40 square miles.

Land use in the basin is predominately rural with pastures and citrus groves. Elevations vary from sea level to approximately 135 feet MSL on Kennedy Hill northeast of Tampa (Menke, et al., 1961).

The Tampa Bypass Canal system, now partially completed, generally follows the Palm River and Sixmile Creek canals and diverts flood waters from Hillsborough River to McKay Bay.

Alafia River Basin - The Alafia River Basin drains the south-central portion of the Planning Area (Figure I.4-4) as well as the western portion of Polk County (Figure I.6-3).

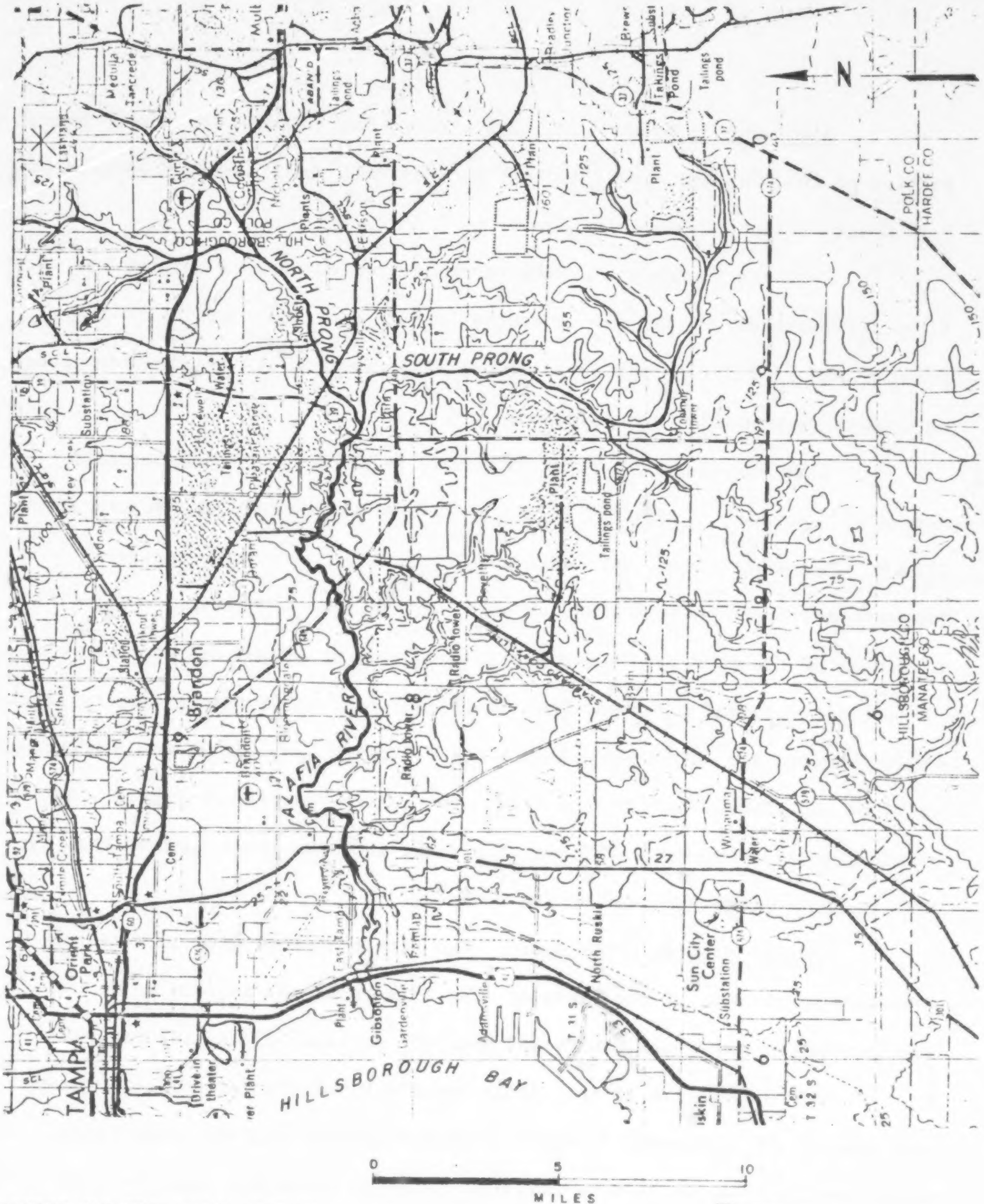
From its headwaters in the phosphate region of Polk County, the river flows approximately 24 miles in a southerly direction, discharging at the southern end of Hillsborough Bay. The Alafia River and its tributaries drain an area of approximately 460 square miles.

Land use along the river is primarily agricultural (63 percent), forest (21 percent), industrial (9 percent) and marsh-swamp (3 percent) (FDER, 1979a). Phosphate mines, both active and inactive, are common near the headwaters and vegetable farming is prominent in the coastal area. The remainder of the area includes numerous small citrus groves and improved pasture interspersed with many fish ponds and confined livestock feeding areas. While improved and unimproved pasture and scattered specialty farms predominate south of the river, north of the river are the rapidly developing areas of Brandon, Valrico and Dover. Elevations range from sea level to more than 140 feet in the eastern portions of the basin.

Little Manatee River Basin - The Little Manatee River drains the southernmost portion of the Planning Area (Figure I.4-4) as well as southwestern Hillsborough County and northern portions of Manatee County.

The Headwaters of the Little Manatee River are located in a swampy area east of Ft. Lonesome, Florida. From the headwaters, the river flows approximately 40 miles in a westerly direction to Tampa Bay near the town of Ruskin. The area drained is approximately 225 square miles, of which approximately 20 square miles are in the Planning Area.

The Little Manatee River Basin is predominately rural. Land uses are agriculture (89 percent), forestry (8 percent) and residential (1 percent)


N
NORTH PRONG
SOUTH PRONG
ALAFIA RIVER
HILLSBOROUGH BAY
TAMPA
Orient Park
Brandon
Gibsonton
Gardenville
Sun City Center
North Ruskin
Ruskin
Wimauma
Substation
Tailings pond
Plant
Radio tower
HILLSBOROUGH CO
POLK CO
POLK CO
HARDEE CO
HILLSBOROUGH CO
MANATEE CO
0
5
10
MILES

SOURCE: U.S. GEOLOGICAL SURVEY
1: 250,000 MAPS, 1956a,
1956b.

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ALAFIA RIVER

DAMES & MOORE

FIGURE I.6-3

(FDER, 1979c). Elevations range from sea level to approximately 100 feet near the river's source.

Bullfrog Creek Basin - Bullfrog Creek drains the southwestern corner of the Planning Area (Figure I.4-4). The upstream half of the basin is located outside of the Planning Area.

Bullfrog Creek'a headwaters are just north of Wimauma. The creek flows approximately 15 miles northwesterly to Hillsborough Bay entering about one mile south of the mouth of the Alafia. Bullfrog Creek's drainage basin encompasses approximately 40 square miles.

The drainage basin is predominately rural, sandy land dotted with ponds and sinkholes. The lower portions of the basin, however, are becoming increasingly urbanized. Land uses for the Bullfrog Creek basin are agriculture (89 percent), forestry (8 percent), residential (1 percent) and industrial (1 percent) (FDER, 1979b). Land elevations range from sea level to 140 feet MSL on ridges in the upper reaches of the basin.

Sweetwater Creek Basin - A small portion of the Planning Area along the northwestern boundary is part of the Sweetwater Creek Basin (Figure I.4-4).

Sweetwater Creek drains about 25 square miles of Hillsborough County. From its headwaters at Lake Magdalene the creek flows westward to Bay Lake, southward to Lake Ellen and then southwesterly to Old Tampa Bay.

The portion of the Planning Area in the sweetwater Creek Basin is primarily urbanized, especially around the creek's headwater lakes. Elevations vary from sea level to 55 feet MSL around Lake Magdalene.

Delaney Creek Basin - The Delaney Creek Basin drains the area west and southwest of the town of Brandon in the central portion of the Planning Area through an extensive system of canals and drainage ditches (Figure I.4-4).

Delaney Creek discharges into Hillsborough Bay. The natural watercourse is approximately 3 miles in length.

Even though Archie Creek discharges directly to Hillsborough Bay it is included in the Delaney Creek Basin. Archie Creek lies approximately 2 miles south of Delaney Creek and drains the low-lying area west of Riverview. Canals and drainage ditches divide the area between the creeks and drain to Hillsborough Bay.

The Delaney Creek Basin is predominately rural. Much of the area consists of low-lying swamps and lakes. However, the area is becoming increasingly urbanized with the construction of single-family housing developments on the outskirts of Brandon and near the coast. Surface elevations in the basin range from sea level to approximately 50 feet MSL near Brandon.

No flow data or water quality data are available for Archie Creek.

Lakes - Lakes are common in Hillsborough County but the majority are located outside the Planning Area. However, the largest natural lake in Hillsborough County, Lake Thonotosassa, and the largest manmade lake, Pleasant Grove Reservoir, are both within the Planning Area.

Pleasant Grove is located in eastern central Hillsborough County utilizing a large, mined-out phosphate mine. The reservoir functions as a flood-control structure and is managed to produce one of the best bass fisheries in the area (Dames & Moore, 1975).

Pleasant Grove Reservoir is one of two manmade reservoirs located within the Planning Area, the other is Tampa Reservoir which stores water in the Hillsborough River channel. Its average depth is 15 feet.

Lake Thonotosassa, in the Hillsborough River Basin, is a favorite recreational area (Figure I.7-2). Its average depth is approximately 10 feet with a maximum depth of 14 feet.

The southern tip of Lake Magdalene is also in the Planning Area. It is used for recreation and has depths up to 24 feet but the average is about 5 feet.

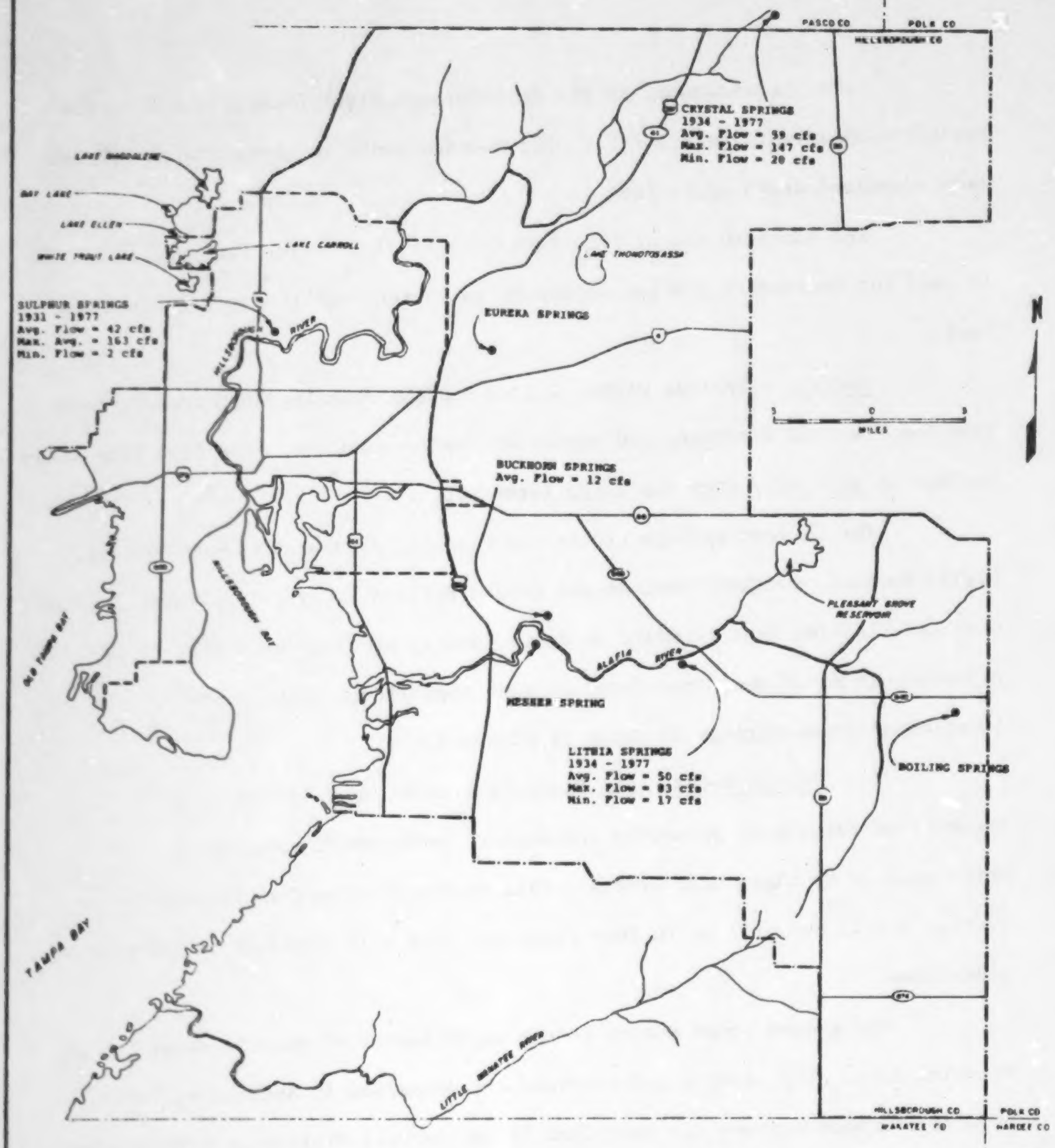
Springs - Springs within and around the Planning Area provide base flow for the area's streams and supplement water supplies. The flow from these springs is generally from the Tampa formation.

The largest springs within the Planning Area are Sulphur Springs, Lithia Springs, Buckhorn Springs and Eureka Springs. Crystal Springs, located near the Planning Area boundary in Pasco County, provides base blow to the Hillsborough River and, therefore, is also significant to this study. The location of these springs is shown in Figure I.6-4).

1. Ground Water: The Planning Area is underlain by a thick sequence of relatively permeable sedimentary rocks which comprise a multi-aquifer hydrogeologic system. This system is described in part in Section I.4.1, but will be further discussed here with emphasis on hydrologic conditions.

The ground water system is the major source of potable water for the Planning Area. The water supply systems are described in Section I.10.6. Details of those systems are described in the Central Hillsborough County-Tampa 201 Facilities Plan.

Within the multi-aquifer system there are generally three hydrologic units; 1) the shallow or water table aquifer, 2) the shallow or secondary artesian aquifer and 3) the principal artesian aquifer (Floridan Aquifer).


PASCO CO
POLK CO
HILLSBOROUGH CO
CRYSTAL SPRINGS
1934 - 1977
Avg. Flow = 59 cfs
Max. Flow = 147 cfs
Min. Flow = 20 cfs
LAKE MAGDALENE
BAY LAKE
LAKE ELLEN
LAKE CARROLL
WHITE TROUT LAKE
LAKE THONOTOSASSA
SULPHUR SPRINGS
1931 - 1977
Avg. Flow = 42 cfs
Max. Avg. = 163 cfs
Min. Flow = 2 cfs
EUREKA SPRINGS
HILLSBOROUGH RIVER
N
MILES
BUCKHORN SPRINGS
Avg. Flow = 12 cfs
OLD TAMPA BAY
HILLSBOROUGH BAY
PLEASANT GROVE RESERVOIR
ALAFIA RIVER
MESHER SPRING
LITHIA SPRINGS
1934 - 1977
Avg. Flow = 50 cfs
Max. Flow = 83 cfs
Min. Flow = 17 cfs
BOILING SPRINGS
TAMPA BAY
LITTLE MANATEE RIVER
HILLSBOROUGH CO
POLK CO
MANATEE CO
HARDEE CO

SOURCE:
U.S.G.S. 1978a
WEST COAST REGIONAL WATER SUPPLY AUTHORITY, 1978

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201 FACILITY PLAN
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MAJOR LAKES AND SPRINGS
WITHIN THE PLANNING AREA

DAMES & MOORE

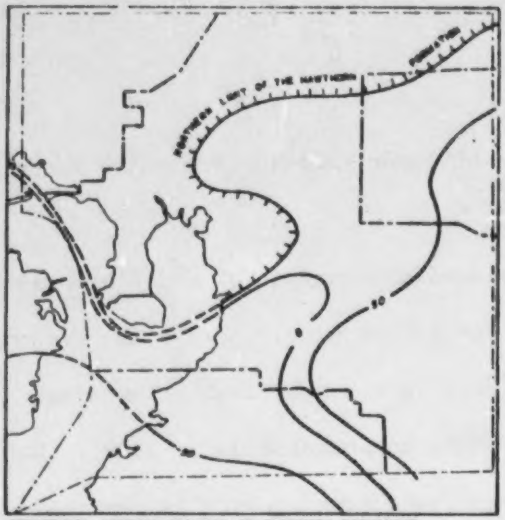
FIGURE I 6-4

These units are separated by sediments of lower permeability which function as confining or semi-confining beds.

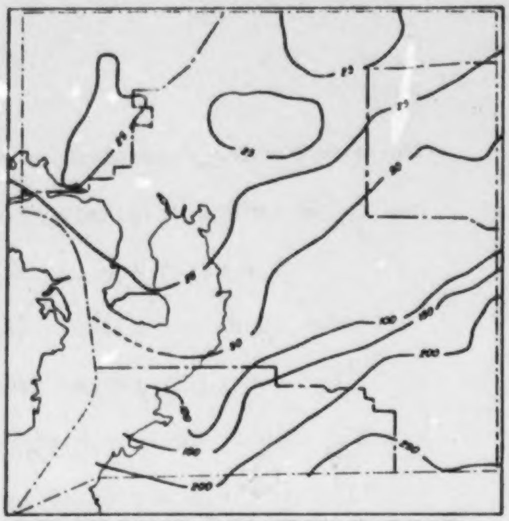
The water table (unconfined) aquifer consists of undifferentiated surficial sands and clays. Its thickness varies widely across the Planning Area, but generally ranges from a few feet in topographically low areas to greater than 50 feet in higher areas (USGS, unpublished data, 1979). Water supplies on the order of 10 gallons per minute (gpm), which is generally suitable for domestic use, may be obtained from the aquifer. The water table surface conforms to the topography in a subdued manner, being deepest in topographically high areas and shallowest in low areas. Depth to the water table is shallow over most of the area (See Section I.4.1 - Table I.4-2)

The base of the shallow aquifer is coincident with the top of the clays of the upper confining bed. These clays belong, in a large part, to the Hawthorn formation but also may include younger undifferentiated sediments which overlie the Hawthorn formation. In the northwest part of the study area where the Hawthorn formation is missing (Figure I.6-5) upper confining bed consists principally of clays of the Tampa formation. The thickness of these units (Figure I.4-6) in the Planning Area ranges from zero at limestone outcrops in the northeast to more than 250 feet in the southeast.

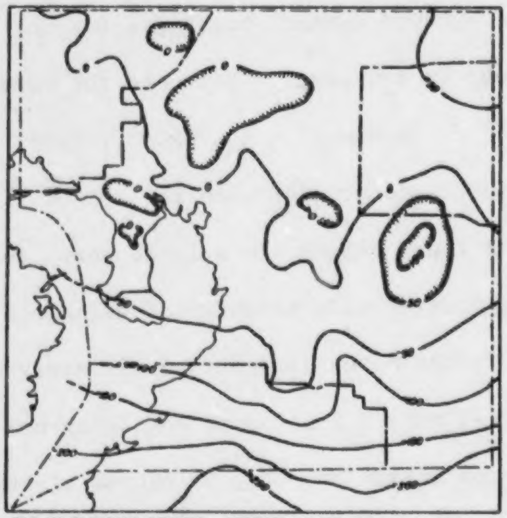
Sand and limestone beds in the Hawthorn formation comprise the secondary artesian aquifer. It is confined above by the clays of the upper part of the Hawthorn formation or the lower part of the undifferentiated sediments and confined below by the clay of the Tampa formation. The aquifer is discontinuous and variable in its occurrence, depth and thickness. The aquifer occurs only in a small area of Hillsborough County and is not considered to be of major significance (Menke, et al., 1961).



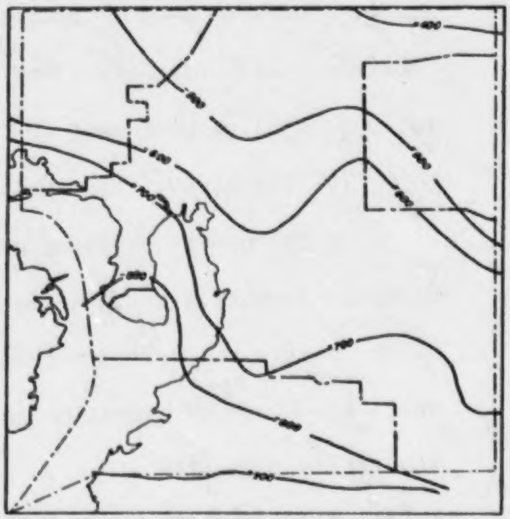
STRUCTURAL CONTOUR MAP TOP OF HAWTHORN FORMATION



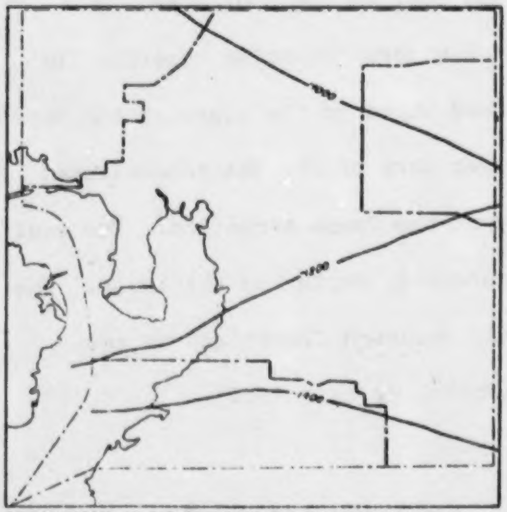
GENERALIZED THICKNESS OF THE CONFINING BED OVERLYING THE FLORIDAN AQUIFER.



TOP OF FLORIDAN AQUIFER. DEFINED AS THE TOP OF FIRST LIMESTONE OF EARLY MIOCENE OR OLDER BELOW WHICH THERE IS NO CONFINING BED.



TOP OF THE MAJOR WATER BEARING ZONES OF THE FLORIDAN AQUIFER. GENERALLY CORRESPONDS TO THE TOP OF A THICK BED OF MASSIVE, HARD, HIGHLY FRACTURED AND OFTEN CAVERNOUS, DARK BROWN DOLOMITE OCCURING IN THE AVON PARK LIMESTONE.



CONFIGURATION OF THE BOTTOM OF THE FLORIDAN AQUIFER. GENERALLY CORRESPONDS TO THE PRESENCE OF EVAPORITES IN THE AVON PARK, LAKE CITY AND OLDSMAR LIMESTONES.

——— 25 ——— GENERALIZED THICKNESS IN FEET OF THE HYDROGEOLOGIC UNIT.

——— -50 ——— STRUCTURE CONTOUR SHOWS ALTITUDE IN FEET OF THE TOP OF THE HYDROGEOLOGIC UNIT. (DATUM: MEAN SEA LEVEL).

0 10 20 30
MILES

HYDROGEOLOGY OF THE HILLSBOROUGH COUNTY AREA, FLORIDA

SOURCE: U.S. GEOLOGICAL SURVEY PRELIMINARY UNPUBLISHED, 1979a THROUGH d, FLORIDA BUREAU OF GEOLOGY UNPUBLISHED DATA, 1979a, CARR, W.J AND ALVERSON, D.C., 1959

DAMES & MOORE

FIGURE I.6-5

Reproduced from best available copy.

The Floridan aquifer is one of the most productive in the world and is the major source of fresh ground water within the Planning Area. It is comprised of limestones and dolomites 1,000 feet or more in thickness. The aquifer includes all of parts of the middle to lower Eocene Avon Park, Lake City and Oldsmar limestones, the upper Eocene Ocala group, the Oligocene Suwannee limestone, and the Tampa limestone and permeable, hydraulically connected parts of the Hawthorn formation.

The generalized contours depicted in Figure I.6-5 marking the bottom of the Floridan aquifer generally correspond to the presence of evaporites in the Avon Park, Lake City and Oldsmar limestones. The depth to the base of the Floridan aquifer in the Planning Area ranges from less than -1000 feet in the northeast to greater than -1400 feet MSL in the southeast. The major water bearing zones of the Floridan aquifer (Figure I.6-5) generally correspond to the top of a thick bed of massive, hard, highly fractured and often cavernous, dark brown dolomite occurring in the Avon Park Limestone. These water producing zones in general are found below -400 feet MSL in the northeast to below -800 feet MSL in the southwest portions of the county (USGS, unpublished data, 1979). A second production zone occurs within the Tampa-Suwannee limestones. Locally, where solution features are well developed, permeability (transmissivity) of this unit may be very high. Recent testing by Hillsborough County hydrologists indicate that in the Brandon area transmissivities in the upper part of the Floridan aquifer may be in excess of one million gallons per day per foot (gpd/ft) (personal communication, L. Hall and S. Metcalf, 1979). The top of the Floridan aquifer (Figure I.6-5) is defined as the top of the first limestone of early Miocene age, or older, below which there is no confining bed. The top of the Floridan aquifer in the Planning Area generally ranges from +50 feet MSL in the northeast to near -200 feet MSL in the southeast (USGS, unpublished data, 1979).

Recharge-Discharge - All ground waters are ultimately derived from rainfall which recharges the aquifer. Recharge occurs where hydrogeologic conditions such as water level, hydraulic gradient and permeability permit rainfall and surface waters to enter the aquifer. Conversely, discharge may occur from the aquifer to the surface waters when ground water levels are at, or above (artesian), the ground surface. The interactions of surface and garound water systems are especially significant in regions such as the Planning Area where high permeability soil and shallow water table permit relatively uninhibited exchange between the systems. These interactions significantly effect the quantity and quality of both hydrologic systems.

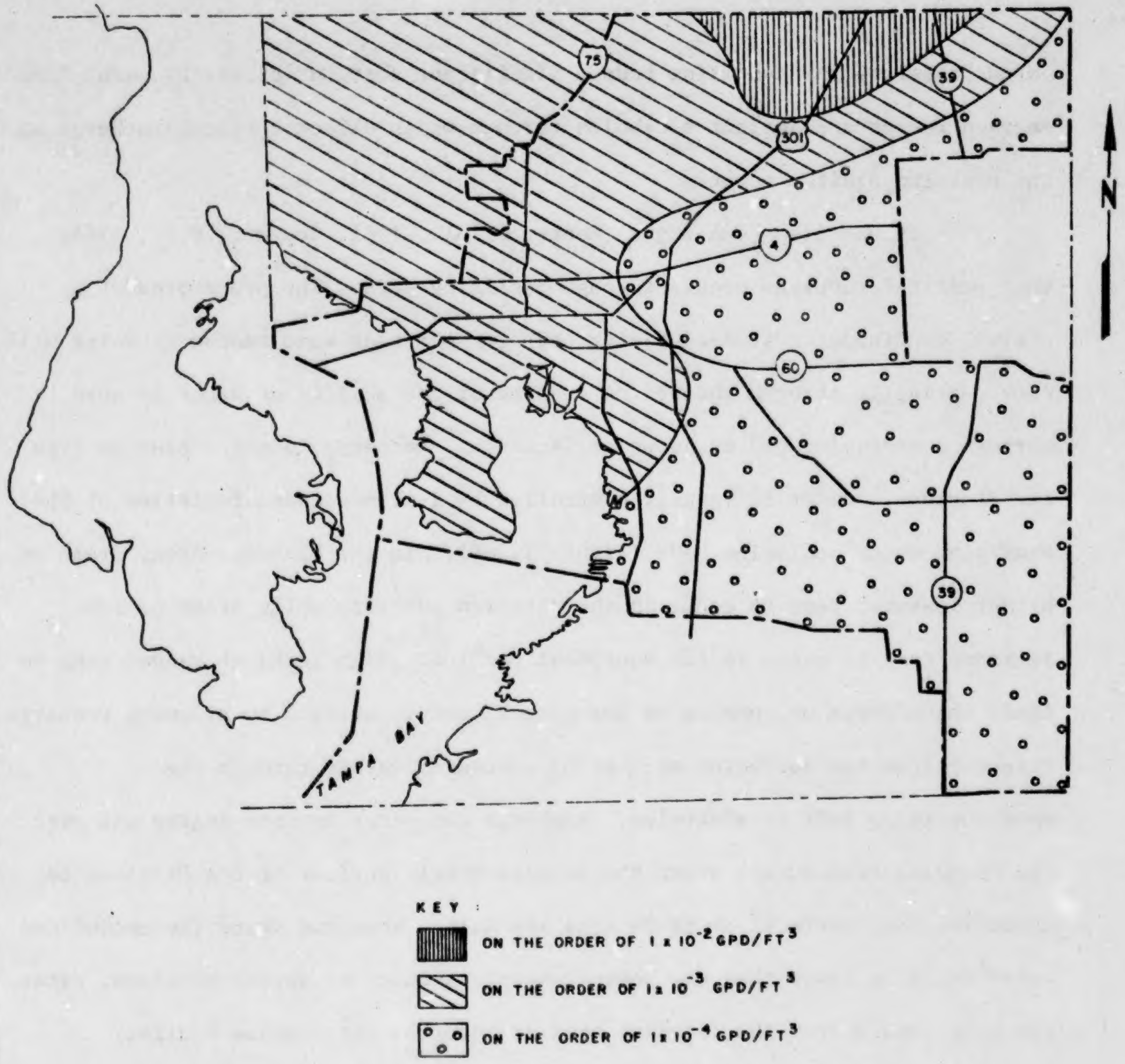
Recharge of the water table aquifer occurs by percolation of the rain water from the shallow soils and by seepage from surface water bodies during periods of high surface water levels. The rate of seepage into the ground in Hillsborough County has been estimated as 450 mgd (Menke, et al., 1961) or 0.43 mgd per square mile. Recharge areas can be generally identified as topographic uplands while discharge areas are generally stream valleys or topographic depressions.

Recharge of the confined artesian aquifers in the Planning Area is somewhat complex, occurring in several ways which include horizontal migration, recharge through sinkholes and vertical leakage through confining beds.

In central and northern Florida, rainfall enters the aquifer in the areas of limestone outcrop. Ground water migrates horizontally through the aquifer from these outcrop areas toward the coast, thus recharging the system (Cooper, et al., 1953). Recharge also occurs through the numerous sinkholes which penetrate the confining beds. Significant portions of the Planning Area contain recent and ancient sinkholes through which direct vertical recharge of the atresian aquifer occurs.

It has also been shown (Menke, et al., 1961; Stewart, H.G., 1966) that vertical recharge occurs through confining beds. The properties of a clayey, confining or semi-confining bed are such that some amount of water will pass vertically through the bed. A measure of the ability of water to move through a confining bed is known as leakance. Recharge to and discharge from the Floridan aquifer is largely controlled by leakance characteristics of the overlying major confining beds (Figure I.6-6). In the Planning Area, areas of higher leakance tend to occur in the northern portion, while areas of low leakance tend to occur in the southwest portion. High leakance values tend to limit the effects of pumping on the potentiometric surface by allowing recharge directly from the surficial aquifer by downward leakage through the semi-confining beds or sinkholes. Recharge can occur to some degree all over the Planning Area except where the potentiometric surface of the Floridan is above the land surface, as it is near the Gulf. When and where the unconfined water table is lower than the potentiometric surface of deeper aquifers, water can move upward from the artesian aquifer into the water table aquifer.

Ground water enters rivers and streams where the potentiometric surface is above the base of the river, primarily from seeps and springs in the river's channel. Ground water supplies much of the base flow of nearly all the streams in the Planning Area. Under normal conditions, about 80 percent of the annual stream flow in the middle Gulf area originates from the Floridan Aquifer (Cherry, et al., 1970).


75
301
39
4
60
39
TAMPA BAY
N
KEY :
ON THE ORDER OF 1 x 10⁻² GPD/FT³
ON THE ORDER OF 1 x 10⁻³ GPD/FT³
ON THE ORDER OF 1 x 10⁻⁴ GPD/FT³

SOURCE : WEST COAST REGIONAL WATER SUPPLY
AUTHORITY, 1978

GENERALIZED LEAKANCE FOR THE CONFINING UNITS OVERLYING THE FLORIDAN AQUIFER

CENTRAL HILLSBOROUGH COUNTY - AREA
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EPA No C120634010

DAMES & MOORE

FIGURE I.6-6

76S01026 (10/79)

b. Quantity: Ground water and surface water are not separate resources, they are parts of the common water supply. Ground water discharge areas and springs supply flow to the major river basins of the Planning Area. Likewise, surface water percolating into surficial sediments or flowing into sinkholes recharges the groundwater supplies of the Planning Area.

1. Surface Water - With the exception of the Tampa Bay system, the surface waters in the Planning Area are greatly influenced by peninsular Florida's climatic conditions (Section I.3). Spring and river flows and lake water levels generally decrease during the dry season when precipitation is slight. Conversely, flows and water levels increase during the wet season when precipitation is greater.

As a result, stream flows fluctuate through a wide range of values. During the dry season, little or no flow will occur in the streams of the Planning Area for as many as 30 consecutive days, on the average of once every 20 years (Texas Instruments, 1978). Spring flows do not vary as greatly as stream flows because of their ground water origin. Lake levels in the Planning Area are generally manipulated by control structures.

During the dry season, the flow in streams and rivers is augmented by inflow of ground water, either directly to the stream channel or from springs. The following subsections describe general flow and water level conditions of the major surface waters in the Planning Area.

Bays - The average fresh water stream flow into the Tampa Bay system is approximately 1550 cubic feet per second (cfs) (1 billion gallons per day) and is derived from four principal tributaries: the Hillsborough River, Alafia River, Little Manatee River and the Manatee River. Of this total inflow, approximately 77 percent flows into Hillsborough Bay primarily through the Hillsborough and Alafia Rivers (Menke, et al., 1961).

Tides in Tampa Bay are considered to be chiefly diurnal with a strong semi-diurnal component. The average tidal range is 2.3 feet with frequent individual events having ranges of 3.5 feet or greater (U.S. Army Corps of Engineers, 1977c). The average tidal range in Hillsborough Bay is approximately 2.5 feet (Goodwin, undated).

The average tidal flow each half-tide cycle at the mouth of Tampa Bay is about 900,000 cfs. At the mouth of Hillsborough Bay, the average tidal flow is about 90,000 cfs. Tidal velocities near the mouth of Tampa Bay frequently reach values of 4 to 6 feet per second. Velocities at the mouth of Hillsborough Bay seldom exceed 0.5 feet per second (Goodwin, undated).

A mathematical hydraulic and dynamic water quality model of the Tampa Bay system developed at the University of South Florida, S.M.F. Engineering Department, under the guidance of Dr. Bernard E. Ross, has been used extensively to model the hydraulic and water quality characteristics of the Tampa Bay system.

Using this model, studies to determine flushing of the Tampa Bay system have shown that a single suspended particle released in upper Old Tampa Bay may take from five to twenty months to leave the bay. A study of flushing times for a dissolved substance showed that a 90 percent reduction in concentrations of a substance in Tampa Bay was achieved in approximately 180 days (Ross, 1978).

The flushing of Hillsborough Bay is "very poor" (Ross, 1979). Two primary flushing mechanisms exist in Hillsborough Bay - river inflow and tidal action. The flushing caused by tidal action is far more dominant than flushing caused by river inflows. However, Hillsborough Bay has little tidal flushing because of the small range in tidal levels (Ross, 1979).

The Tampa Bypass Canal, which is partially completed, diverts fresh water storm discharge into McKay Bay instead of directly into Hillsborough Bay and may aid in flushing of portions of McKay Bay.

Hillsborough River Basin - Three major tributaries, Blackwater Creek, Trout Creek and Cypress Creek drain the northeastern, northern and northwestern segments of the Hillsborough River Basin within Hillsborough County. Other creeks draining either to one of the three major tributaries or directly to the Hillsborough River include Itchepackesassa Creek, Hollomans Branch, Pemberton Creek, Baker Creek, New River, Campbell Branch, Flint Creek and Clay Gulley Creek (Figure I.6-7).

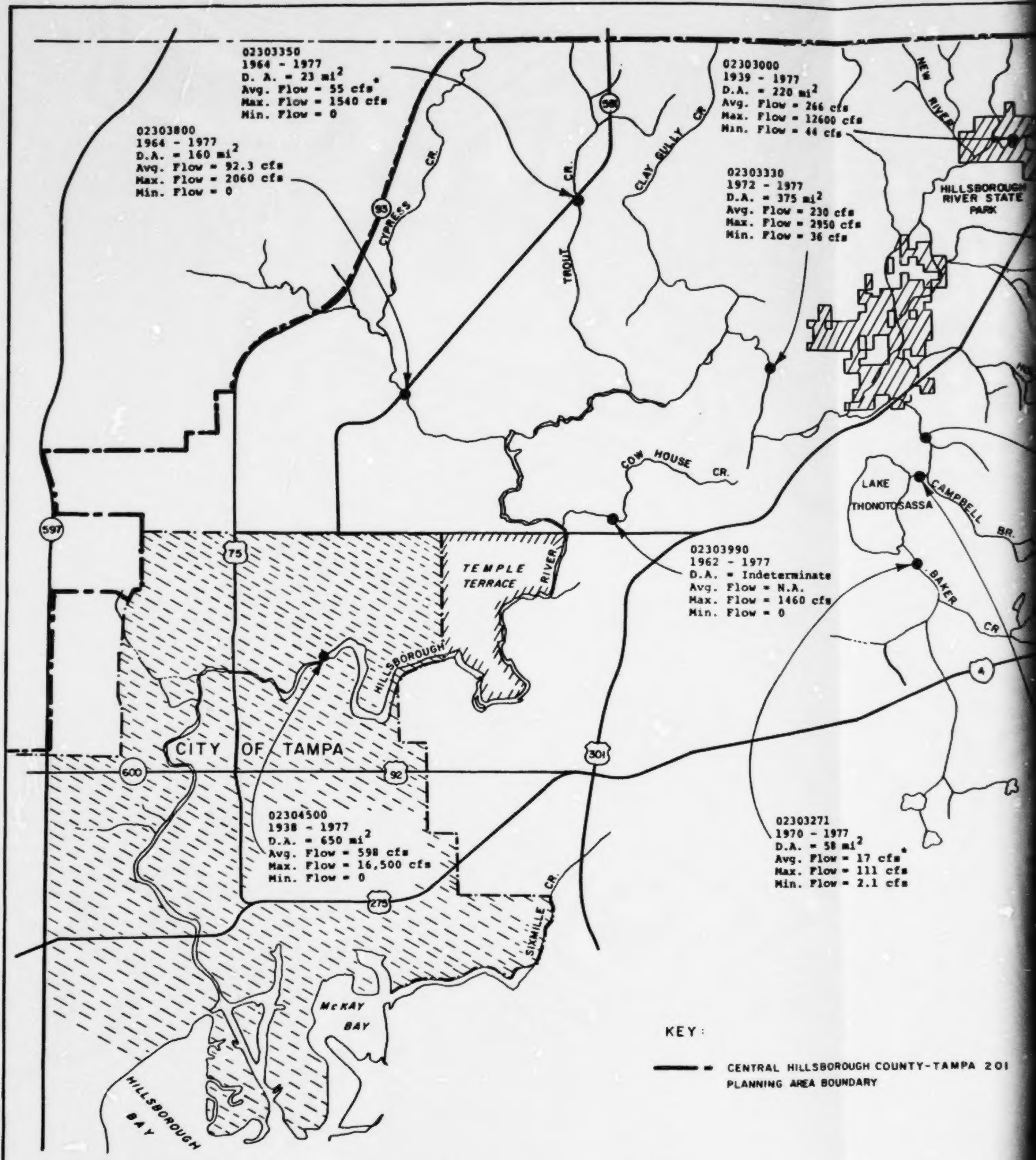
Two springs, Crystal Springs and Sulphur Springs, also contribute flow and probably provide the majority of the river's base flow during low flow conditions.

Flows measured at selected U.S. Geological Survey gauging stations within the Hillsborough River Basin are identified on Figure I.6-7. In addition, drainage areas and the period of record for each station are presented.

Crystal Springs, located in Pasco County, is the primary source of low flow augmentation of the Hillsbaorough River (see Subsection on "Springs"). However, a low flow of zero was recorded downstream at the Tampa Reservoir Dam due to regulation of the dam's discharge structure.

Conversely, a maximum recorded flow of 14,600 cfs was recorded on the Hillsborough River at the Tampa Reservoir Dam on March 21, 1960.

The major regulating/diversion structures in the Hillsborough River Basin are the Tampa Reservoir Dam and the Tampa Bypass Canal system.


02303350
1964 - 1977
D. A. = 23 mi^2
Avg. Flow = 55 cfs*
Max. Flow = 1540 cfs
Min. Flow = 0
02303000
1939 - 1977
D.A. = 220 mi^2
Avg. Flow = 266 cfs
Max. Flow = 12600 cfs
Min. Flow = 44 cfs
02303800
1964 - 1977
D.A. = 160 mi^2
Avg. Flow = 92.3 cfs
Max. Flow = 2060 cfs
Min. Flow = 0
02303330
1972 - 1977
D.A. = 375 mi^2
Avg. Flow = 230 cfs
Max. Flow = 2950 cfs
Min. Flow = 36 cfs
NEW RIVER
HILLSBOROUGH RIVER STATE PARK
CYPRESS CR.
TROUT CR.
CLAY GULLY CR.
COW HOUSE CR.
LAKE THONOTOSASSA
CAMPBELL BR.
BAKER CR
02303990
1962 - 1977
D.A. = Indeterminate
Avg. Flow = N.A.
Max. Flow = 1460 cfs
Min. Flow = 0
TEMPLE TERRACE
RIVER
HILLSBOROUGH
CITY OF TAMPA
02304500
1938 - 1977
D.A. = 650 mi^2
Avg. Flow = 598 cfs
Max. Flow = 16,500 cfs
Min. Flow = 0
02303271
1970 - 1977
D.A. = 58 mi^2
Avg. Flow = 17 cfs*
Max. Flow = 111 cfs
Min. Flow = 2.1 cfs
SIXMILLE CR.
McKAY BAY
HILLSBOROUGH BAY
597
75
93
581
4
301
600
92
275
KEY:
CENTRAL HILLSBOROUGH COUNTY-TAMPA 201 PLANNING AREA BOUNDARY

CENTRAL HILLSBOROUGH COUNTY-TAMPA
201 FACILITY PLAN
ENVIRONMENTAL REPORT
EPA No. C120634010

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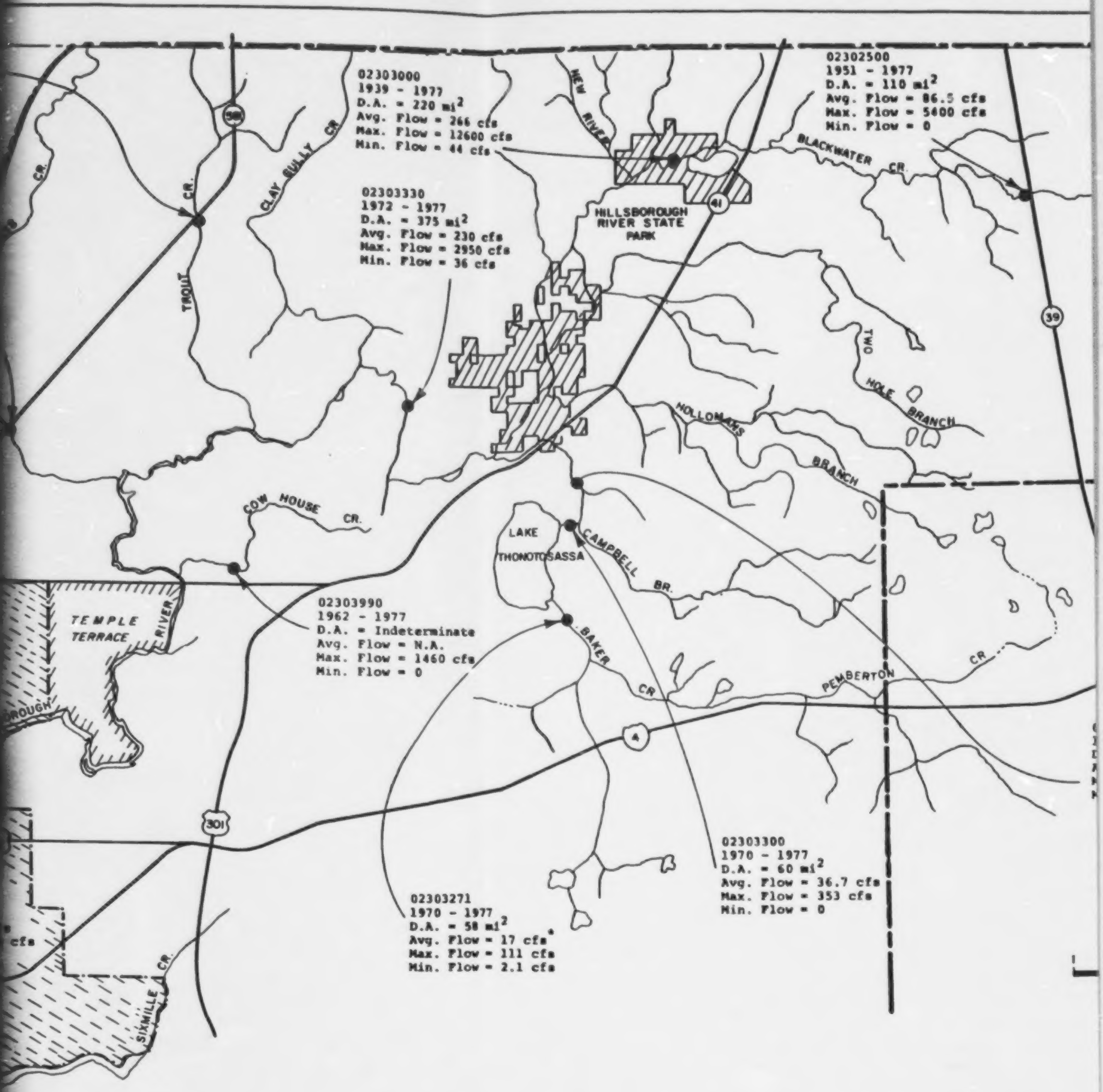
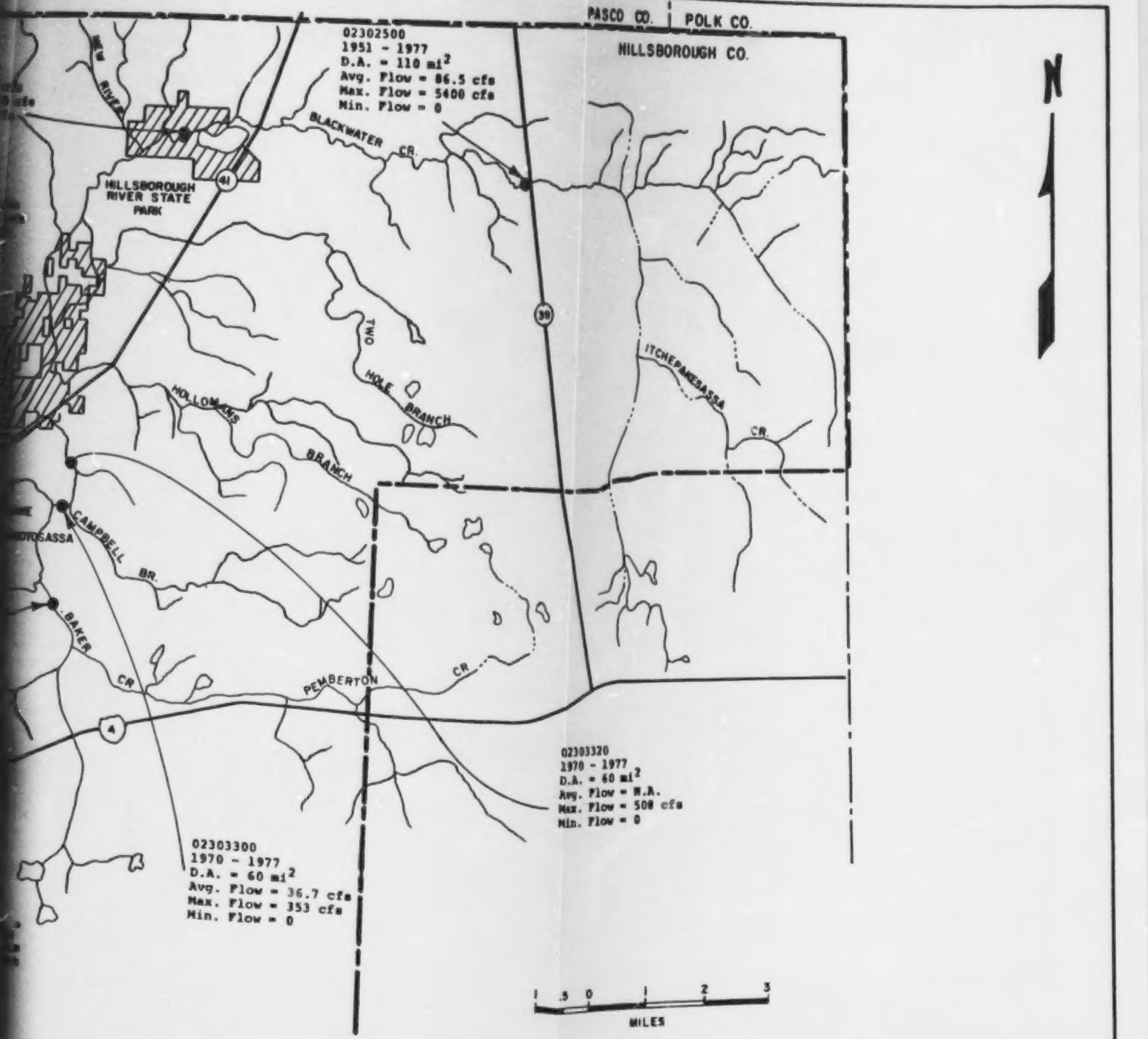

02303000
1939 - 1977
D.A. = 220 mi²
Avg. Flow = 266 cfs
Max. Flow = 12600 cfs
Min. Flow = 44 cfs
02302500
1951 - 1977
D.A. = 110 mi²
Avg. Flow = 86.5 cfs
Max. Flow = 5400 cfs
Min. Flow = 0
02303330
1972 - 1977
D.A. = 375 mi²
Avg. Flow = 230 cfs
Max. Flow = 2950 cfs
Min. Flow = 36 cfs
02303990
1962 - 1977
D.A. = Indeterminate
Avg. Flow = N.A.
Max. Flow = 1460 cfs
Min. Flow = 0
02303300
1970 - 1977
D.A. = 60 mi²
Avg. Flow = 36.7 cfs
Max. Flow = 353 cfs
Min. Flow = 0
02303271
1970 - 1977
D.A. = 58 mi²
Avg. Flow = 17 cfs*
Max. Flow = 111 cfs
Min. Flow = 2.1 cfs
cfs
NEW RIVER
CLAY GULLY CR.
TROUT CR.
CR.
BLACKWATER CR.
HILLSBOROUGH RIVER STATE PARK
TWO HOLE BRANCH
HOLLOMANS BRANCH
COW HOUSE CR.
LAKE THONOTOSASSA
CAMPBELL BR.
BAKER CR
PEMBERTON CR.
TEMPLE TERRACE
RIVER
SIXMILE CR.
98
41
39
4
301

KEY:

CENTRAL HILLSBOROUGH COUNTY-TAMPA 201 PLANNING AREA BOUNDARY

DATA SOURCE: U.S.G.S.
MAP SOURCE: GENERAL
COUNTY,

HILL


PASCO CO.
POLK CO.
HILLSBOROUGH CO.
N
02302500
1951 - 1977
D.A. = 110 mi^2
Avg. Flow = 86.5 cfs
Max. Flow = 5400 cfs
Min. Flow = 0
NEW RIVER
BLACKWATER CR.
HILLSBOROUGH RIVER STATE PARK
41
39
TWO HOLE BRANCH
HOLLOMANS BRANCH
ITCHEPACKESASSA CR.
CAMPBELL BR.
BAKER CR.
PEMBERTON CR.
4
02303320
1970 - 1977
D.A. = 60 mi^2
Avg. Flow = N.A.
Max. Flow = 500 cfs
Min. Flow = 0
02303300
1970 - 1977
D.A. = 60 mi^2
Avg. Flow = 36.7 cfs
Max. Flow = 353 cfs
Min. Flow = 0
1 .5 0 1 2 3
MILES

TY-TAMPA 201

DATA SOURCE : U.S.G.S., 1978
MAP SOURCE : GENERAL HIGHWAY MAP, HILLSBOROUGH COUNTY, 1976

HILLSBOROUGH RIVER AND TRIBUTARIES WITHIN PLANNING AREA

DAMES & MOORE

FIGURE I.6-7

The Tampa Reservoir Dam is located on the Hillsborough River approximately ten miles above the river's mouth. During periods of low flow, no flow is passed over the dam structure. The City of Tampa withdraws water at an average rate of 52 - 55 mgd for treatment for domestic water supply. Additional description of the Tampa Reservoir is presented in the subsection entitled "Lakes".

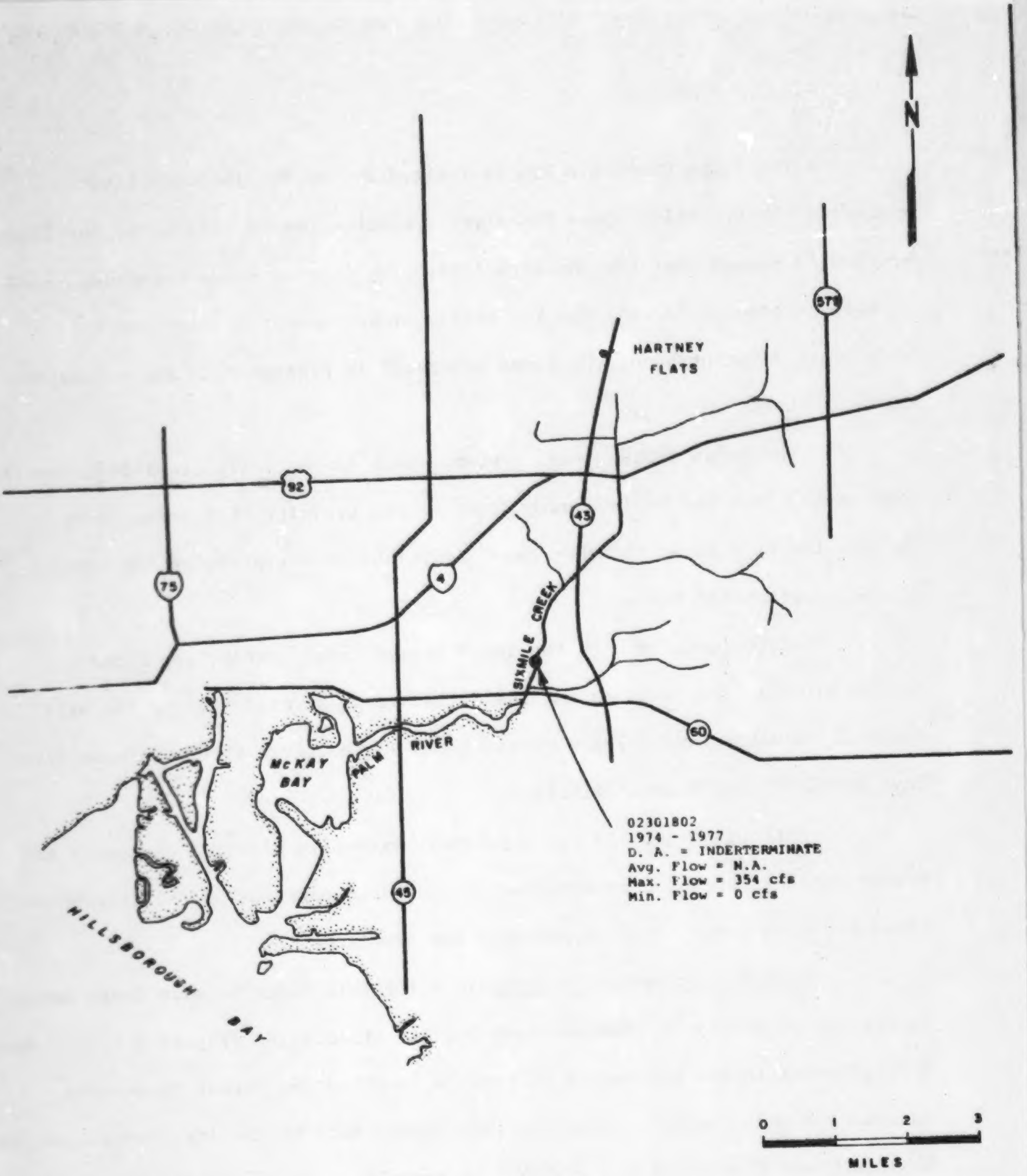
The Tampa Bypass Canal system, which is partially completed, diverts high waters from the Hillsborough River in the vicinity of Cypress Creek through the Palm River to McKay Bay. Additional description of the canal system is presented below.

In conjunction with the Tampa Bypass Canal system, two flood detention areas are proposed for the Hillsborough River. These areas will store flood waters and release excess flows to the river after the peak flows have subsided (see Section I.5.1).

Although generally not regulated, extensive networks of canals and feeder ditches have been constructed in the rural portions of the Hillsborough River Basin to drain improved pastures and croplands.

Palm River/Sixmile Creek Basin - The Palm River/Sixmile Creek Basin is drained primarily by Sixmile Creek and its tributaries (Figure I.6-8). Many springs exist in the headwaters of Sixmile Creek in the Harney Flats area including Eureka Springs. These springs supply much of the dry season flow for Sixmile Creek (Menke, et al., 1961). Lettuce Lake, in the Harney Flats, is a flowing sinkhole which discharges at a rate of 12 cfs (TBRPC, 1976).

Few flow records are available for either Sixmile Creek or Palm River, although it has been estimated that the average discharge at the mouth of the Palm River is 86 cfs (Texas Instruments, 1978).


N
HARTNEY
FLATS
575
92
43
75
4
SIXMILE CREEK
60
McKAY
BAY
PALM RIVER
45
HILLSBOROUGH BAY
0
1
2
3
MILES

02301802
1974 - 1977
D. A. = INDERTERMINATE
Avg. Flow = N.A.
Max. Flow = 354 cfs
Min. Flow = 0 cfs

SOURCE : HILLSBOROUGH CO., 1976

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PALM RIVER / SIXMILE CREEK
BASIN

DAMES & MOORE

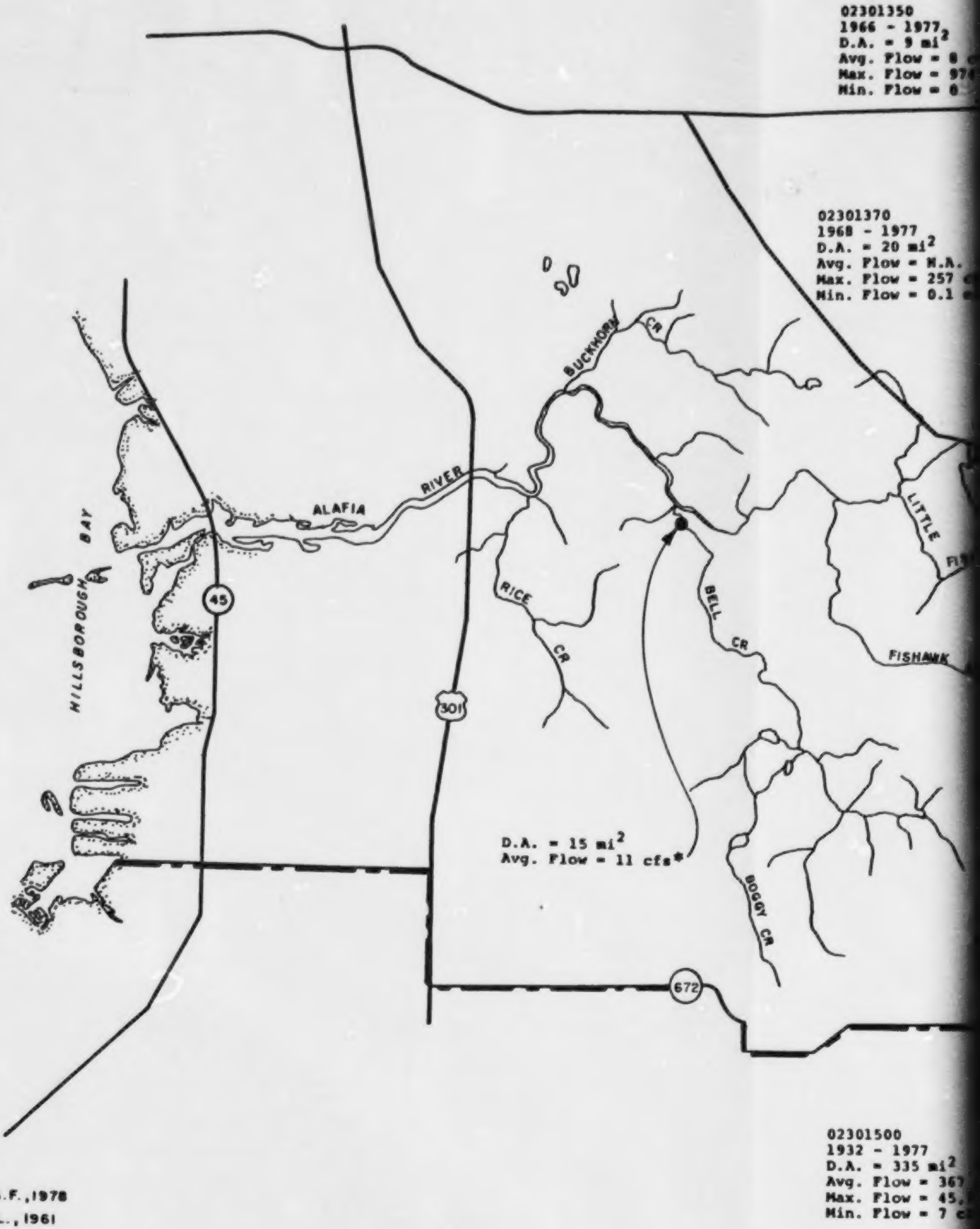
FIGURE I.6-B

The Tampa Bypass Canal system, now partially completed, has changed the characteristics of the Palm River/Sixmile Creek Basin. The Bypass system was designed by the U.S. Army Corps of Engineers to divert high flows of the Hillsborough River around the urban areas of Temple Terrace and the City of Tampa and discharge the flows to McKay Bay. The system consists of three canal segments: the Tampa Bypass Canal (C-135), the Harney Canal (C-136) and the Thonotosassa Canal (C-132) as shown on Figure I.5-2. The Harney Canal has been completed and, during rains of up to 17 inches on May 8, 1979, successfully alleviated potential flooding in downtown Tampa and Temple Terrace (SWFWMD, 1979).

The Tampa Bypass Canal is the longest segment and will divert flows from the Hillsborough River and the other canals to Sixmile Creek and the Palm River. Because portions of the canal bottom were excavated into the Floridan Aquifer, ground water may flow into portions of the canal. Structures have been constructed to maintain surface water levels to retard ground water inflow (Figure I.5-2). Estimates of ground water discharge to the canal system range from 23 cfs to 39 cfs (WCRWSA, 1978).

Alafia River Basin - Two major tributaries, the South Prong Alafia River and the North Prong Alafia River, drain the southern and eastern portions of the Alafia River Basin, respectively (Figure I.6-9). These tributaries join approximately four miles east of the town of Lithia to form the Alafia River proper. Other substantial tributaries in the basin within the Planning Area include the Little Alafia River, Turkey Creek, Fishhawk Creek and Bell Creek.

Flows have been measured at several USGS stations in the river basin. These stations, as well as pertinent flow data, are shown in Figure I.6-9. Stream flow can vary widely throughout the basin and many of the creeks dry


02301350
1966 - 1977
D.A. = 9 mi^2
Avg. Flow = 8 c
Max. Flow = 97
Min. Flow = 0
02301370
1968 - 1977
D.A. = 20 mi^2
Avg. Flow = N.A.
Max. Flow = 257 c
Min. Flow = 0.1 c
BUCKHORN CR
ALAFIA RIVER
HILLSBOROUGH BAY
LITTLE FI
FISHAWK
RICE CR
BELL CR
BOGGY CR
45
301
672
D.A. = 15 mi^2
Avg. Flow = 11 cfs*
02301500
1932 - 1977
D.A. = 335 mi^2
Avg. Flow = 367
Max. Flow = 45,
Min. Flow = 7 c

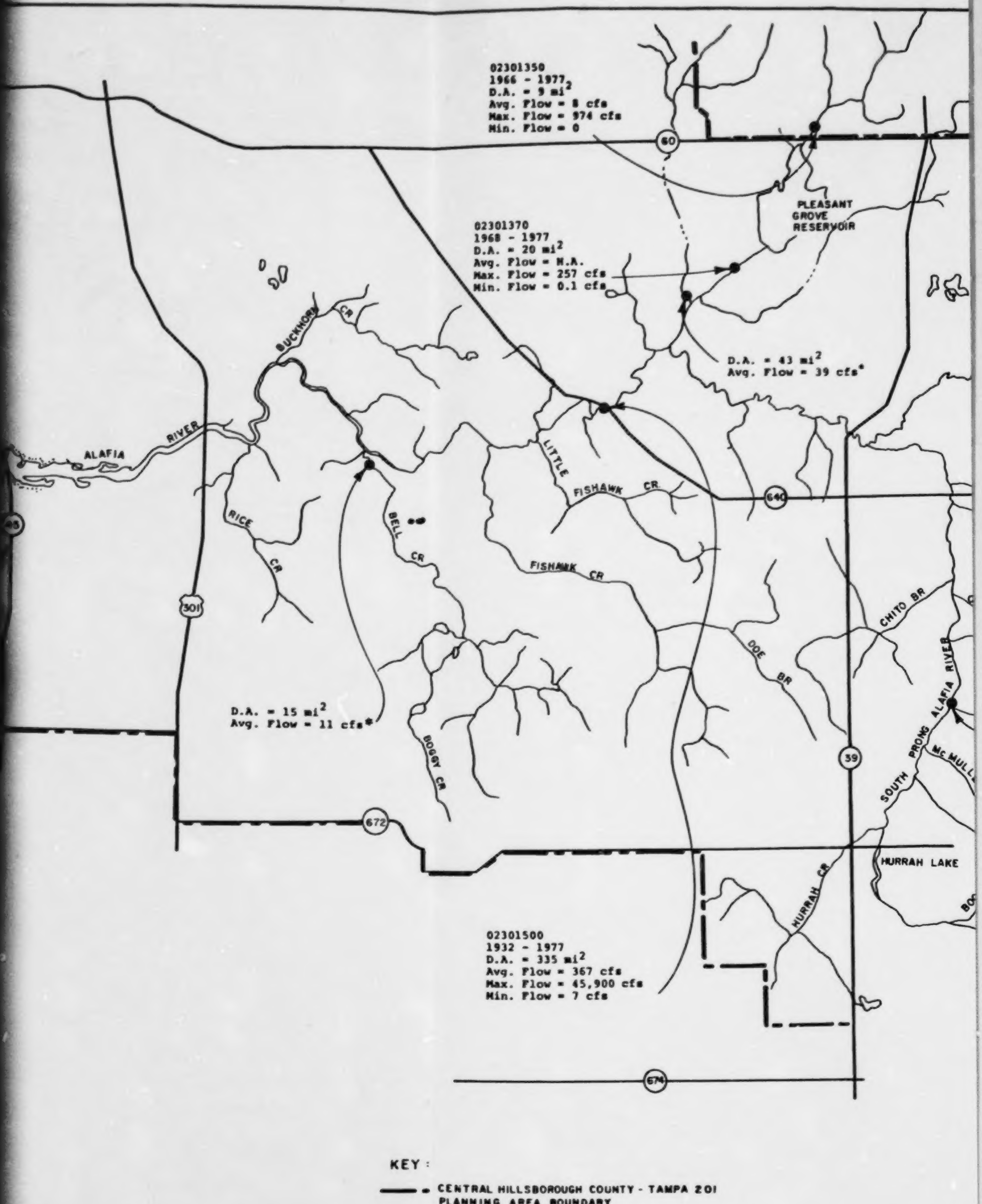
DATA SOURCE: ROBERTSON, A.F., 1978
* MENKE, ET AL., 1961

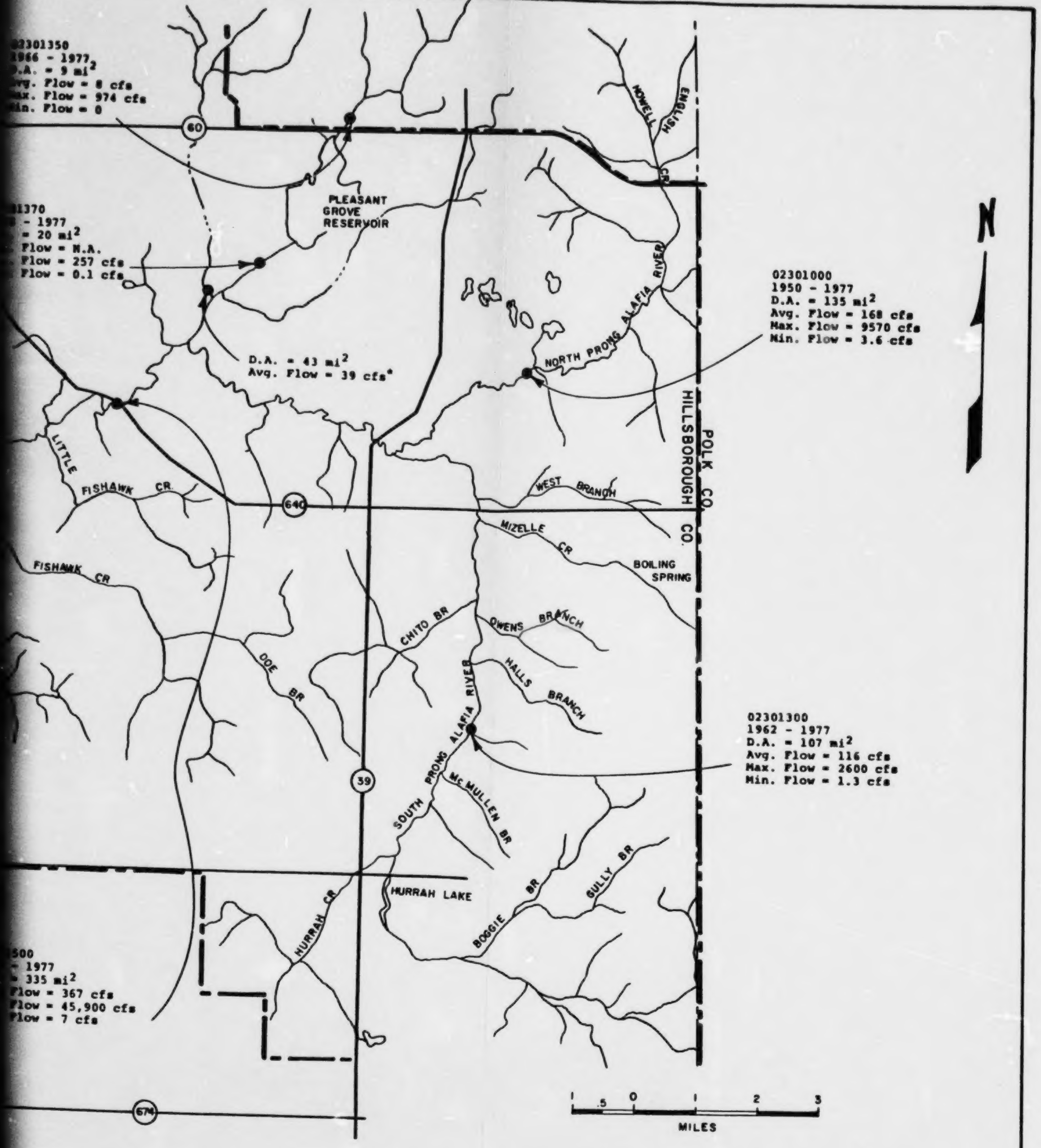
MAP SOURCE: GENERAL HIGHWAY MAP, HILLSBOROUGH COUNTY, 1976

CENTRAL HILLSBOROUGH COUNTY - TAMPA
201 FACILITY PLAN
ENVIRONMENTAL REPORT
EPA No. C120634010

KEY:

—— = CENTRAL HILLSBOROUGH
PLANNING AREA BOUND


02301350
1966 - 1977
D.A. = 9 mi^2
Avg. Flow = 8 cfs
Max. Flow = 974 cfs
Min. Flow = 0
60
PLEASANT
GROVE
RESERVOIR
02301370
1968 - 1977
D.A. = 20 mi^2
Avg. Flow = N.A.
Max. Flow = 257 cfs
Min. Flow = 0.1 cfs
D.A. = 43 mi^2
Avg. Flow = 39 cfs*
BUCKHORN CR
ALAFIA RIVER
LITTLE FISHAWK CR.
640
RICE CR
BELL CR
FISHAWK CR
301
CHITO BR
DOE BR
ALAFIA RIVER
SOUTH PRONG
McMULL
D.A. = 15 mi^2
Avg. Flow = 11 cfs*
BOGGY CR
39
672
HURRAH LAKE
HURRAH CR
BOG
02301500
1932 - 1977
D.A. = 335 mi^2
Avg. Flow = 367 cfs
Max. Flow = 45,900 cfs
Min. Flow = 7 cfs
674
KEY:
CENTRAL HILLSBOROUGH COUNTY - TAMPA 201
PLANNING AREA BOUNDARY


02301350
1966 - 1977
D.A. = 9 mi²
Avg. Flow = 8 cfs
Max. Flow = 974 cfs
Min. Flow = 0
60
PLEASANT
GROVE
RESERVOIR
1370
- 1977
= 20 mi²
Flow = N.A.
Flow = 257 cfs
Flow = 0.1 cfs
D.A. = 43 mi²
Avg. Flow = 39 cfs*
HOWELL
ENGLISH
CR
NORTH PRONG ALAFIA RIVER
02301000
1950 - 1977
D.A. = 135 mi²
Avg. Flow = 168 cfs
Max. Flow = 9570 cfs
Min. Flow = 3.6 cfs
N
LITTLE
FISHAWK CR.
640
WEST BRANCH
POLK CO.
HILLSBOROUGH CO.
MIZELLE CR
BOILING SPRING
FISHAWK CR
OWENS BRANCH
CHITO BR
DOE BR
HALLS BRANCH
ALAFIA RIVER
SOUTH PRONG
McMULLEN BR
39
02301300
1962 - 1977
D.A. = 107 mi²
Avg. Flow = 116 cfs
Max. Flow = 2600 cfs
Min. Flow = 1.3 cfs
HURRAH LAKE
HURRAH CR
BOGGIE BR
GULLY BR
500
- 1977
= 335 mi²
Flow = 367 cfs
Flow = 45,900 cfs
Flow = 7 cfs
674
1 .5 0 1 2 3
MILES
BOROUGH COUNTY - TAMPA 201
A BOUNDARY

ALAFIA RIVER AND TRIBUTARIES WITHIN PLANNING AREA

DAMES & MOORE

FIGURE I.6-9

during portions of the year. The maximum flow on record is 45,900 cfs. The average annual flow of the Alafia River at the mouth is approximately 450 cfs (U.S. Army Corps of Engineers, 1977a).

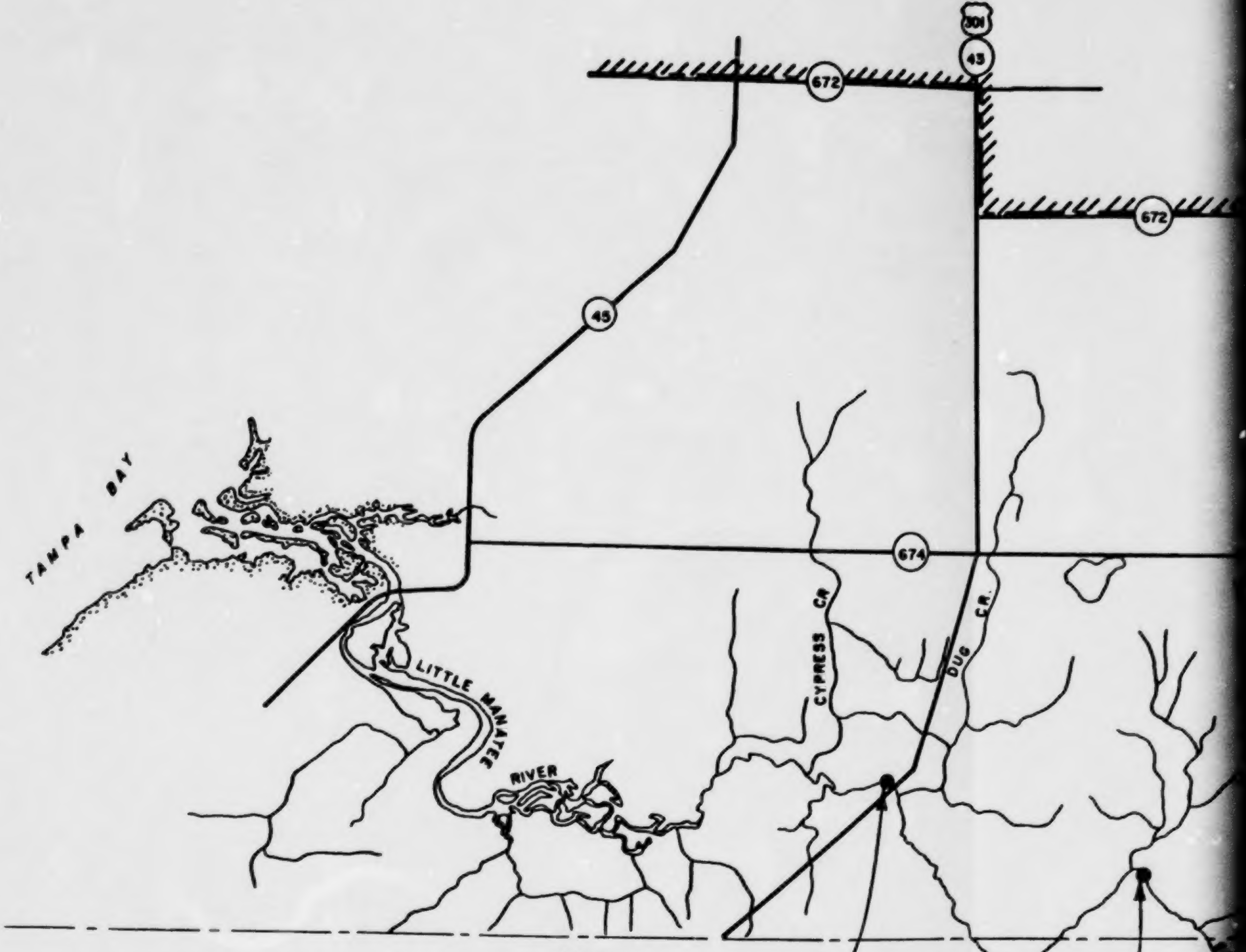
Flows from Lithia Springs and Buckhorn Springs contribute to the baseflow of the Alafia River. These springs contribute 12 to 27 percent of the total flow during low flow (October - May) periods (TBRPC, 1977b). Further description of these springs are presented in the subsection entitled "Springs".

The lower reaches of the Alafia River are tidal. During periods of low flow, tidal effects can be observed within a few miles of the Bell Shoals Road bridge, approximately ten miles upstream of the river mouth (Robertson, A.F., 1978).

The only major control structure within the Planning Area portion of the Alafia River Basin is Pleasant Grove Reservoir (Figure I.6-9) which is fed by the Little Alafia River and by a tributary of Turkey Creek. The reservoir is used for flood control pruposes during periods of high flow (see Subsection "Lakes"). Upstream mining practices probably influence stream flows to some degree.

Little Manatee River Basin - The mainstream Little Manatee River and one of its tributaries, Alderman Creek, drain the largest portion of the Planning Area. Other major tributaries in this drainage basin which fall outside the Planning Area include South Fork Little Manatee River, Howard Prairie Branch, Pierce Branch and Carlton Branch (Figure I.6-10).

Flows have been measured by the U.S. Geological Survey in the Little Manatee River at two locations. These stations and pertinent flow data are shown in Figure I.6-10. Flows can vary from no-flow in the river's upper


301
43
672
672
45
674
TAMPA BAY
LITTLE MANATEE RIVER
CYPRESS CR.
DUG CR.

02300500
1939 - 1977
D.A. = 149 mi^2
Avg. Flow = 170 cfs
Max. Flow = 14,000 cfs
Min. Flow = 0.78 cfs

D.A. = 40 mi^2
Avg. Flow = 47 cfs*

SOURCE : ROBERTSON, A.F.,
* MENKE, ET AL., 1961

SOURCE : HILLSBOROUGH COUNTY
1976

CENTRAL HILLSBOROUGH COUNTY - TAMPA 201
PLANNING AREA BOUNDARY

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ACILITY PLAN
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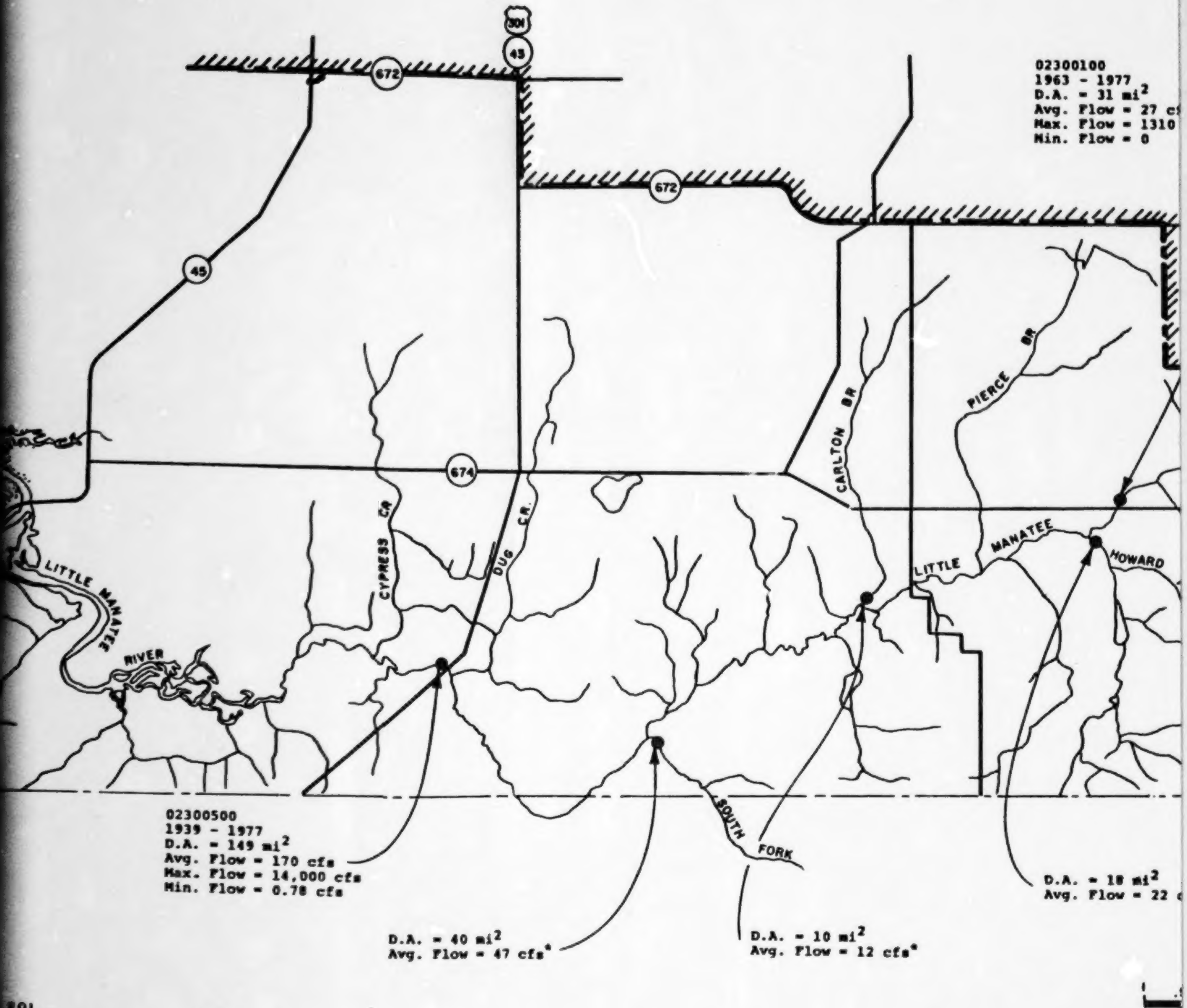
C120634010


301
45
672
672
45
674
CYPRESS CR.
DUG CR.
CARLTON BR.
PIERCE BR.
LITTLE MANATEE
HOWARD
LITTLE MANATEE
RIVER
SOUTH
FORK

02300100
1963 - 1977
D.A. = 31 mi^2
Avg. Flow = 27 c
Max. Flow = 1310
Min. Flow = 0

02300500
1939 - 1977
D.A. = 149 mi^2
Avg. Flow = 170 cfs
Max. Flow = 14,000 cfs
Min. Flow = 0.78 cfs

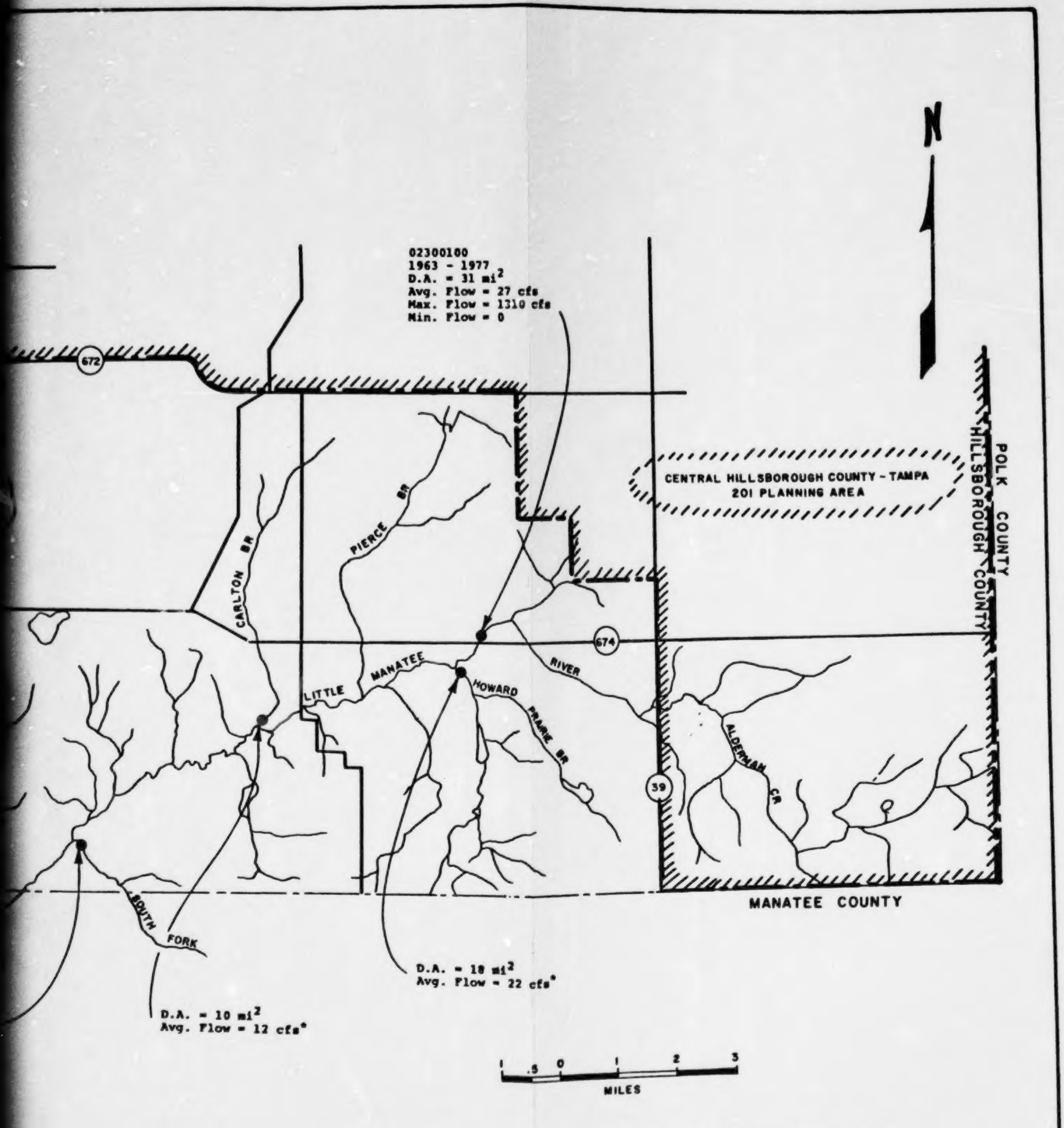
D.A. = 40 mi^2
Avg. Flow = 47 cfs*

D.A. = 10 mi^2
Avg. Flow = 12 cfs*

D.A. = 18 mi^2
Avg. Flow = 22 c

201

LITTL


N
02300100
1963 - 1977
D.A. = 31 mi^2
Avg. Flow = 27 cfs
Max. Flow = 1310 cfs
Min. Flow = 0
672
674
39
CENTRAL HILLSBOROUGH COUNTY - TAMPA
201 PLANNING AREA
POLK COUNTY
HILLSBOROUGH COUNTY
MANATEE COUNTY
CARLTON BR
PIERCE BR
LITTLE MANATEE RIVER
HOWARD PRARIE BR
ALDERMAN CR
SOUTH FORK
D.A. = 18 mi^2
Avg. Flow = 22 cfs*
D.A. = 10 mi^2
Avg. Flow = 12 cfs*
1 .5 0 1 2 3
MILES

LITTLE MANATEE RIVER AND TRIBUTARIES

DAMES & MOORE

FIGURE I.6-10

reaches to the maximum recorded discharge of 14,000 cfs. The no-flow condition is relatively common in the basin during dry periods. Average annual discharge at the river's mouth is approximately 250 cfs (U.S. Army Corps of Engineers, 1977a). On the Little Manatee, tidal effects are observed as much as 15 miles upstream at the USGS recording station on Highway 301.

No major control structures exist in the river basin within the Planning Area.

Bullfrog Creek Basin - The largest tributary to Bullfrog Creek is Little Bullfrog Creek which drains a portion of the basin adjacent to the Planning Area boundary (Figure I.6-11).

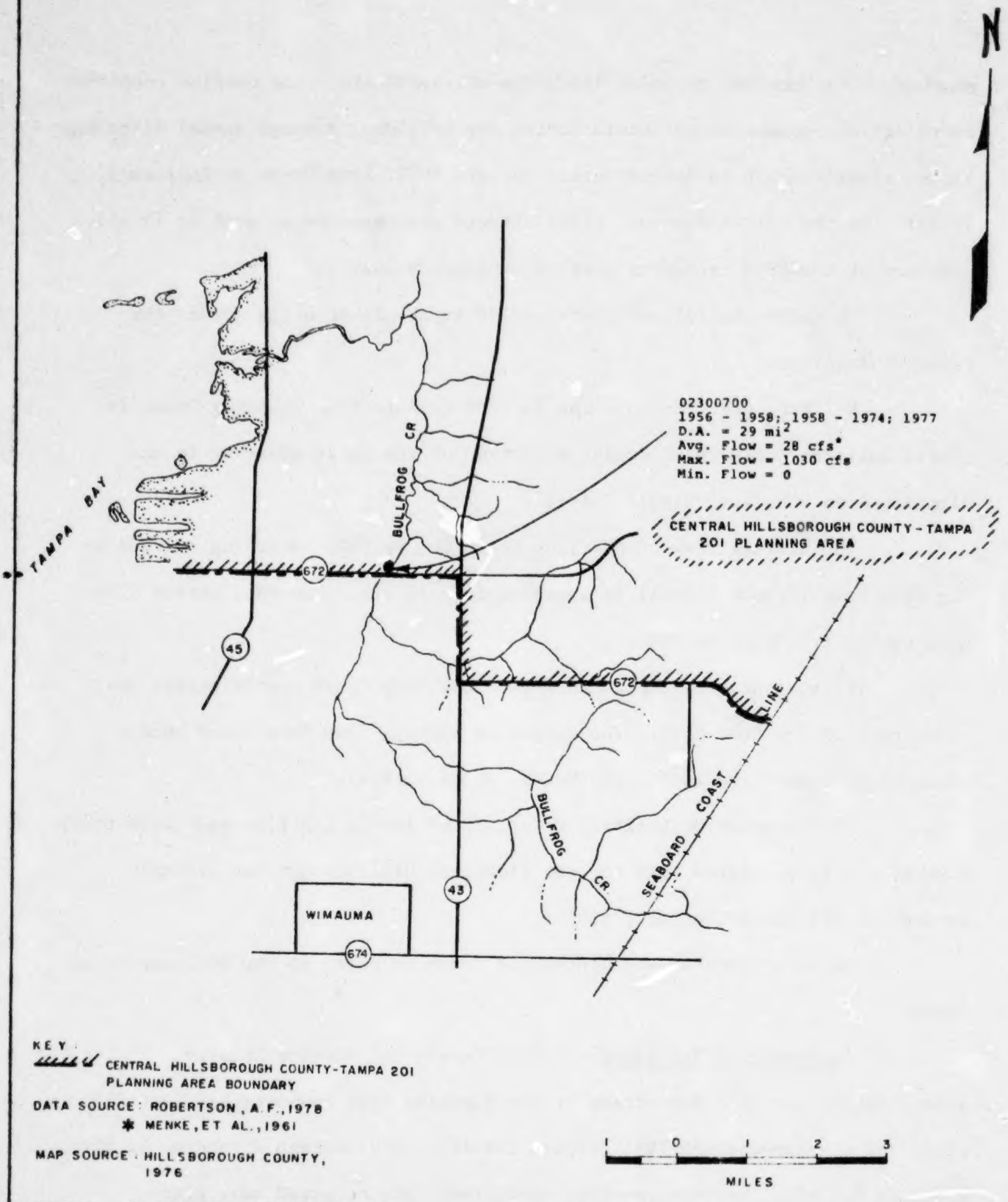
The average flow of Bullfrog Creek at the USGS recording station at Big Bend Road (Figure I.6-11) is approximately 28 cfs. However, stream flows have varied from zero to 960 cfs.

Little Bullfrog Creek flows into Bullfrog Creek approximately one mile south of Big Bend Road. The estimated average flow from the 9 square miles of drainage area is 11 cfs (Menke, et al., 1961).

At the mouth of Bullfrog Creek, water levels and flow vary with tidal levels. It is estimated that the net flow into Hillsborough Bay probably exceeds 47 cfs (Menke, et al., 1961).

No major control structures are known to exist in the Bullfrog Creek Basin.

Sweetwater Creek Basin - A U.S. Geological station located approximately one mile downstream of the Planning Area boundary has recorded stage and discharge since 1951 (Figure I.6-12). The average discharge at this point is 6.4 cfs. However, no-flow conditions have occurred many times. Sweetwater Creek has less surface water yield than other local watersheds


N
TAMPA BAY
BULLFROG CR
672
45
43
674
WIMAUMA
SEABOARD COAST LINE
CENTRAL HILLSBOROUGH COUNTY-TAMPA 201 PLANNING AREA
0
1
2
3
MILES

02300700
1956 - 1958; 1958 - 1974; 1977
D.A. = 29 mi^2
Avg. Flow = 28 cfs*
Max. Flow = 1030 cfs
Min. Flow = 0

KEY:
▨ CENTRAL HILLSBOROUGH COUNTY-TAMPA 201 PLANNING AREA BOUNDARY

DATA SOURCE: ROBERTSON, A.F., 1978
* MENKE, ET AL., 1961

MAP SOURCE: HILLSBOROUGH COUNTY, 1976

CENTRAL HILLSBOROUGH COUNTY-TAMPA
201 FACILITY PLAN
ENVIRONMENTAL REPORT
EPA No. C120634010

BULLFROG CREEK BASIN

765601026 (6/79)

DAMES & MOORE

FIGURE I.6-11

with less surface storage because the numerous lakes detain the water and allow for greater losses due to seepage and evaporation (Menke, et al., 1961).

Since 1970, flow has been diverted from the Sweetwater Creek Basin below the USGS station through Channel G to the Rocky Creek Basin.

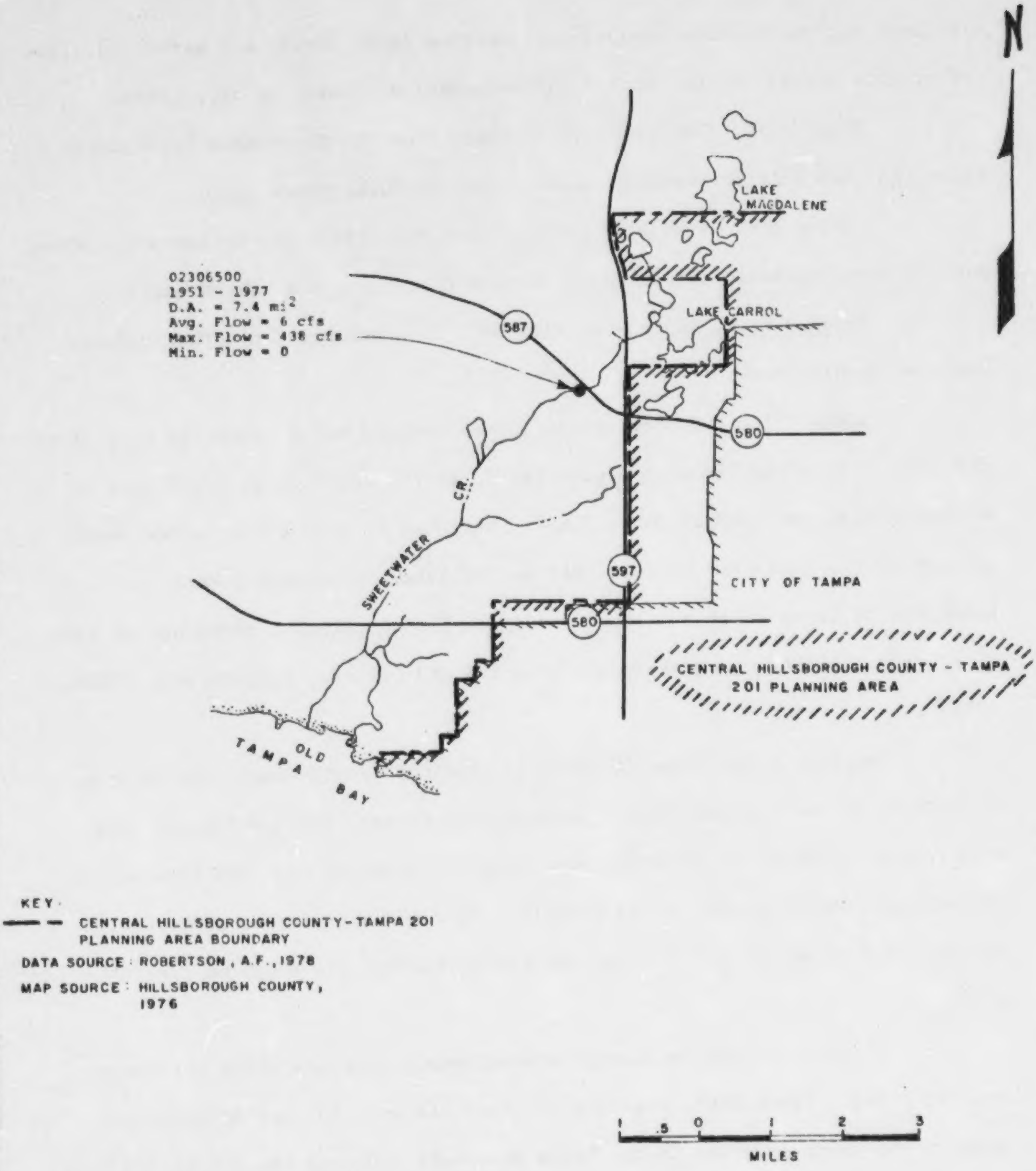
During periods of high water, water flows from the Hillsborough River Basin to the Sweetwater Creek Basin between Platt Lake and Lake Magdalene.

Delaney Creek Basin - No flow data is available for either Delaney Creek or Archie Creek.

Lakes - The U.S. Geological Survey records water levels in several of the lakes within the Planning Area. The lakes for which water level data is available are presented in Table I.6-1. As shown in this table, water levels in most of the lakes can be regulated at the lake's discharge points. Locations of these lakes are shown on Figure I.6-4. Average flows out of Lake Thonotosassa and Lake Magdalene are 36.7 cfs and 0.2 cfs, respectively (USGS, 1978a).

Springs - The flows of the major springs provide base flow to streams and rivers in the Planning Area. In addition, Crystal Springs located less than a mile north of the Planning Area boundary sustains the base flow of the Hillsborough River (Menke, et al., 1961). Flow characteristics of Crystal Springs as well as Sulphur Springs and Lithia Springs are shown on Figure I.6-4.

Sulphur Springs is located approximately 1½ miles below the Tampa Reservoir Dam. Since 1964, the City of Tampa has used Sulphur Springs to augment the water supplies in the Tampa Reservoir. During the dry season when the flow in the Hillsborough River is low, as much as 20 to 25 cfs is diverted


N
LAKE MAGDALENE
LAKE CARROL
02306500
1951 - 1977
D.A. = 7.4 mi^2
Avg. Flow = 6 cfs
Max. Flow = 438 cfs
Min. Flow = 0
587
580
597
580
SWEETWATER CR.
CITY OF TAMPA
CENTRAL HILLSBOROUGH COUNTY - TAMPA 201 PLANNING AREA
OLD TAMPA BAY
KEY
CENTRAL HILLSBOROUGH COUNTY-TAMPA 201 PLANNING AREA BOUNDARY
DATA SOURCE: ROBERTSON, A.F., 1978
MAP SOURCE: HILLSBOROUGH COUNTY, 1976
1 .5 0 1 2 3
MILES

CENTRAL HILLSBOROUGH COUNTY-TAMPA
201 FACILITY PLAN
ENVIRONMENTAL REPORT
EPA No C120634010

SWEETWATER CREEK BASIN

76560-026 (6/79)

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FIGURE I.6-12

TAB

MAJOR LAKES WHOLLY

PLANN

NAME	USGS STATION NO.	SURFACE AREA (ACRES)	DRAINAGE AREA (SQ. MI.)	PERIOD OF RECORD	WATER
					MAX. FT. MSL
PLEASANT GROVE RESERVOIR	02301368	850	19.6	1970 - 1975	61.2
LAKE THONOTOSASSA	02303290	824	60	1965 - 1975	38.6
BAY LAKE	02306300	37	2.5	1946 - 1975	46.8
LAKE ELLEN	02306371	50	4.2	1946 - 1956 1971 - 1975	41.7
LAKE CARROLL	02306600	188	1.7	1946 - 1975	40.1
LAKE MAGDALENE	02306200	232	1.7	1946 - 1975	51.0

SOURCE: U.S.G.S., 1978.

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TABLE I.6-1

MAJOR LAKES WHOLLY OR PARTIALLY WITHIN THE PLANNING AREA

USGS STATION NO.	SURFACE AREA (ACRES)	DRAINAGE AREA (SQ. MI.)	PERIOD OF RECORD	WATER LEVELS		
				MAX. FT. MSL	MIN. FT. MSL	
02301368	850	19.6	1970 - 1975	61.2	50.5	Reservoir is formed by concrete dam with mining area. Level is controlled by co weir plates on two 6-foot (1.8 m) culve
02303290	824	60	1965 - 1975	38.6	34.0	Lake level partially controlled by concr Hillsborough River.
02306300	37	2.5	1946 - 1975	46.8	41.5	Lake is one of the Sweetwater Creek head boards.
02306371	50	4.2	1946 - 1956 1971 - 1975	41.7	36.6	Inflow into lake regulated by control at
02306600	188	1.7	1946 - 1975	40.1	32.4	Lake is one of the Sweetwater Creek hea by culvert; high-water outflow is south
02306200	232	1.7	1946 - 1975	51.0	42.0	Lake is the largest of the Sweetwater C removable boards.

978a

TABLE I.6-1

S WHOLLY OR PARTIALLY WITHIN THE PLANNING AREA

WATER LEVELS		
MAX. FT. MSL	MIN. FT. MSL	REMARKS
61.2	50.5	Reservoir is formed by concrete dam with earthen embankments, and is fed by the Little Alafia River and runoff from adjacent mining area. Level is controlled by concrete control structure with automatic control gage on one 6-foot (1.8 m) culvert, weir plates on two 6-foot (1.8 m) culverts, and slide gate on one 5-foot (1.5 m) culvert.
38.6	34.0	Lake level partially controlled by concrete control structure with removable boards. Outflow is through Flint Creek to Hillsborough River.
46.8	41.5	Lake is one of the Sweetwater Creek headwaters chain of lakes. Outlet has a small concrete control structure with removable boards.
41.7	36.6	Inflow into lake regulated by control at Bay Lake outlet and outflow regulated by control at Lake Ellen outlet.
40.1	32.4	Lake is one of the Sweetwater Creek headwaters chain of lakes. Outflow from lake is to White Trout Lake partially controlled by culvert; high-water outflow is southwestward to Sweetwater Creek.
51.0	42.0	Lake is the largest of the Sweetwater Creek headwaters chain of lakes. Outlet has small concrete control structure with removable boards.

from the springs to Tampa Reservoir (Goetz, et al., 1976). Flow is regulated by operating gates and stoplogs in control structures at the swimming pool outlet at the head of the springs.

Buckhorn Springs and Lithia Springs are located in the Alafia River Basin (Figure I.6-4). Both springs feed directly to the Alafia River. Lithia Springs is actually two springs located approximately 19 miles upstream of the river mouth. Buckhorn Springs is located approximately one-half mile north of the river and flows into Buckhorn Creek before entering the Alafia. Water is pumped from this spring by Gardinier, Inc. to supply a plant at Gibsonton (Menke, et al., 1961).

Other springs in the Alafia River Basin include Messer Spring and Boiling Spring. Average flow of these springs is less than 10 cfs (Texas Instruments, 1978).

Eureka Springs is one of many springs forming the headwaters of Palm River/Sixmile Creek (Figure I.6-4). Eureka Springs is composed of four springs. Flow from the springs was estimated to be 9 cfs in 1961 (Smith & Gillespie).

c. Quality:

1. Surface Water: As stated in the Areawide Water Quality Management Plan for the Tampa Bay Region (TBRPC, 1978a), which includes the Planning Area:

> "Surface water quality in the Tampa Bay Region is generally acceptable, even good, although in most cases some water quality standard (usually dissolved oxygen, bacteria or pH) is periodically violated. This may be due to natural causes and the water is not always unsuitable for its intended usage (recreation, fish and wildlife habitat, etc.)".

> "Excessive nutrient concentrations appear from the data to be the region's most widespread problem. Urban/suburban stormwater runoff and agricultural runoff (particularly from livestock operations) are the principal sources of pollution in the region, with the former apparently predominating".

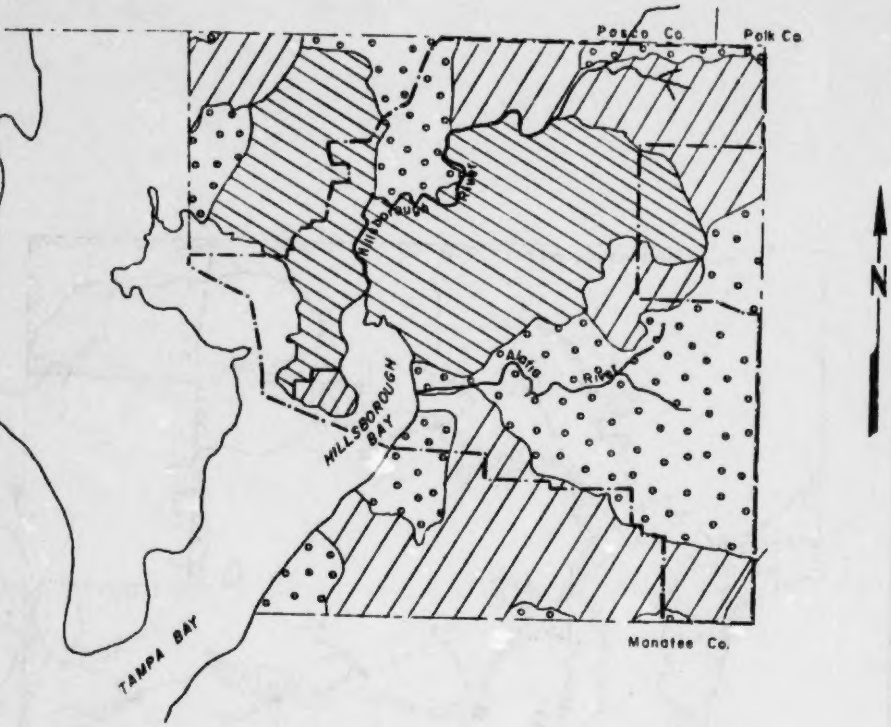
Figure I.6-13 indicates the severity of water quality problems in the Planning Area by water quality management planning boundary sub-segments. This figure can be compared with the land use maps (Figure I.2-4). As stated in the Areawide Water Quality Management Plan for the Tampa Bay Region (TBRPC, 1978a):

> "It is apparent that urbanization, together with poor flushing of many bays and bayous, has a pronounced impact on the region's water bodies, Nonpoint sources of water pollution are significant contributors".

Water quality characteristics of most of the surface waters in the Planning Area are presented in Table I.6-2. This table presents maximum, minimum and average concentrations of select water quality parameters for the period January, 1970 to December, 1976. Locations of the stream segments presented in the table are shown on Figure I.6-14. These data were compiled by Texas Instruments for the Central Florida Phosphate Industry Areawide Impact Assessment Program from water quality data collected by the Florida Department of Environmental Regulation and the United States Geological Survey.

The waters of the Planning Area have been classified according to suitability of waters for usage established by Chapter 17-3.081 of the Florida Administrative Code (Water Quality Standards). Table I.6-3 presents the different classifications.

Most of the surface waters in the Planning Area have been classified as Class III waters (Recreation - Propagation and Management of Fish and Wildlife) as shown on Figure I.6-15. The Hillsborough River from the Tampa


Pasco Co.
Polk Co.
Hillsborough River
Alafia River
HILLSBOROUGH BAY
TAMPA BAY
Manatee Co.
N

KEY:

▧ SERIOUS WATER QUALITY PROBLEMS

▨ POTENTIAL WATER QUALITY PROBLEMS

⁘ INSIGNIFICANT WATER QUALITY PROBLEMS

— - — CENTRAL HILLSBOROUGH COUNTY - TAMPA 201 PLANNING

SOURCE: ENVIRONMENTAL SCIENCE AND ENGINEERING, INC., 1977

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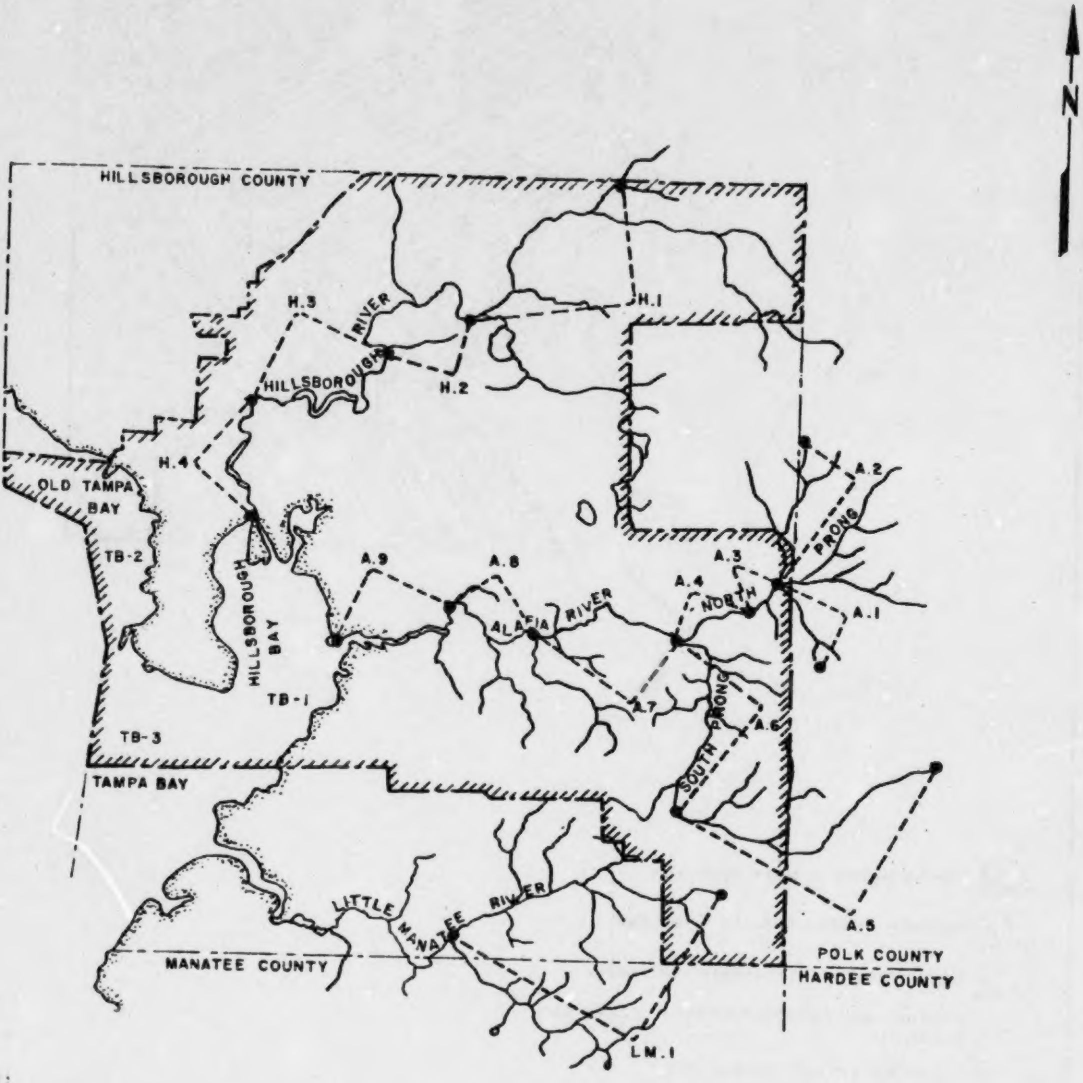
EPA No. C120634010

GENERALIZED EXISTING WATER QUALITY
HILLSBOROUGH COUNTY

DAMES & MOORE

FIGURE I.6-13


N
HILLSBOROUGH COUNTY
H.1
H.2
H.3
HILLSBOROUGH RIVER
H.4
OLD TAMPA BAY
TB-2
HILLSBOROUGH BAY
TB-1
TB-3
TAMPA BAY
A.9
A.8
ALAFIA RIVER
A.4
A.3
NORTH PRONG
A.2
A.1
A.7
SOUTH PRONG
A.6
A.5
LITTLE MANATEE RIVER
MANATEE COUNTY
POLK COUNTY
HARDEE COUNTY
LM.1

KEY:

▨ CENTRAL HILLSBOROUGH COUNTY - TAMPA 201 PLANNING AREA

H.1, H.2, ··· RIVER SEGMENT FOR WHICH WATER QUALITY DATA IS PRESENTED IN TABLE 3.6-2

SOURCE · ADAPTED FROM TEXAS INSTRUMENTS, 1978

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CENTRAL HILLSBOROUGH COUNTY - TAMPA
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WATER QUALITY SEGMENTS

DAMES & MOORE

FIGURE I.6-14

CHARACTERISTIC WATER QUALITY

Designation on Map		Alkalinity (mg/ℓ $CaCO_3$)	BOD_5 (mg/ℓ)	Color (Pt. Co unit)	Conductivity (mho/cm)	Dissolved Oxygen (mg/ℓ)	Fluoride (mg/ℓ)
A.1	Max	90	–	–	-	6.6	4.6
	Min	12	–	–	-	6.6	0.5
	Avg	47	–	–	-	6.6#	2.1
A.2	Max	158	2.6	30	560	8.0	44.0
	Min	14	2.6	30	560	8.0	0.5
	Avg	76	2.6#	30#	560#	8.0#	3.8
A.3	Max	57	1.3	60	1,530	10.4	22.0
	Min	2	0.0	10	221	2.2	1.9
	Avg	34	0.7	32	833	7.0	10.7
A.4	Max	120	8.9	110	393	11.0	0.8
	Min	4	0.8	14	152	1.1	0.3
	Avg	48	2.3	34*	222	6.2	0.6
A.5	Max	258	–	–	–	5.4	44.0
	Min	16	–	–	-	1.4	0.3
	Avg	64	–	–	-	3.0#	6.2
A.6	Max	148	1.3	160	2,450	10.0	6.6
	Min	2	0.4	2	171	0.8	0.5
	Avg	52	1.0	63	382	6.5	3.3
A.7	Max	680	3.7	130	1,140	10.2	55.0
	Min	0	0.1	10	210	1.8	0.3
	Avg	57	1.1	49	599	7.0	5.8
A.8	Max	120	8.5	114	1,280	12.1	14.4
	Min	20	0.2	5	152	3.9	0.2
	Avg	46*	2.6*	39*	566*	6.7*	5.6*
A.9	Max	310	11.1	43	45,900	12.8	12.0
	Min	20	0.0	5	14,000	0.3	0.7
	Avg	76	2.6	15	33,049	6.1	4.6
H.1	Max	272	33.0	160	1,580	12.5	6.0
	Min	0	0.2	0	58	1.7	0.0
	Avg	124	4.4	56	337	5.9	0.6
H.2	Max	212	9.0	200	614	10.6	1.6
	Min	23	0.1	3	134	1.7	0.1
	Avg	97	2.9	55	305	6.1	0.5
H.3	Max	146	3.6	140	419	10.5	–
	Min	68	0.4	4	140	0.9	–
	Avg	113	1.3	50	299	4.7	–
H.4	Max	127	5.0	80	9,800	8.6	0.6
	Min	13	0.8	20	110	1.5	0.2
	Avg	97#	2.2+	50#	907	6.1	0.3
LM.1	Max	10	1.2	120	1,260	10.2	0.4
	Min	10	0.4	120	62	3.1	0.4
	Avg	10#	0.9+	120#	157	6.6	0.4#
TB.1	Max	110	6.1	48	43,000	11.1	5.0
	Min	67	0.7	3	18,800	0.0	1.0
	Avg	97*	2.7	13	36,205	5.2	2.5
TB.2	Max	112	12.1	27	64,800	10.4	2.0
	Min	82	0.1	0	17,500	2.2	0.5
	Avg	99*	3.1	11	43,203	6.7	1.6
TB.3	Max	117	8.2	42	55,900	14.4	1.8
	Min	77	0.1	0	18,000	0.6	0.0
	Avg	101	1.5	6	44,053	6.7	1.0

Note: To present as much information as possible from STORET data during January 1970-December
"average" column:

Absence of qualifier signal	The average presented is
*	Average of at least 10
+	Average of less than 10
#	Average of less than 10
–	No data available.

SOURCE : ADAPTED FROM TEXAS INSTRUMENTS, 1978

TABLE I.6-2

CHARACTERISTIC WATER QUALITY FOR PLANNING AREA, JANUARY

Designation on Map		Alkalinity (mg/ℓ CaCO$_3$)	BOD$_5$ (mg/ℓ)	Color (Pt. Co unit)	Conductivity (mho/cm)	Dissolved Oxygen (mg/ℓ)	Fluoride (mg/ℓ)	Nitrate-N (mg/ℓ)	Ammonia-N (mg/ℓ)	Organic-N (mg/ℓ)	pH (pH unit)	Ortho Phosphate (mg/ℓ)
A.1	Max	90	–	–	–	6.6	4.6	1.00	3.70	0.70	8.1	–
	Min	12	–	–	–	6.6	0.5	0.00	0.00	0.56	4.4	–
	Avg	47	–	–	–	6.6#	2.1	0.25	0.19	0.63#	7.0	–
A.2	Max	158	2.6	30	560	8.0	44.0	3.00	1.75	1.47	9.2	68.00
	Min	14	2.6	30	560	8.0	0.5	0.00	0.00	0.25	5.5	1.40
	Avg	76	2.6#	30#	560#	8.0#	3.8	0.94	0.24	0.87	7.3	21.09
A.3	Max	57	1.3	60	1,530	10.4	22.0	4.00	11.80	2.10	7.7	–
	Min	2	0.0	10	221	2.2	1.9	0.00	0.00	0.06	4.8	–
	Avg	34	0.7	32	833	7.0	10.7	0.91	0.70	0.58	6.7	–
A.4	Max	120	8.9	110	393	11.0	0.8	4.00	1.64	1.10	8.3	83.00
	Min	4	0.8	14	152	1.1	0.3	0.00	0.01	0.46	5.8	0.86
	Avg	48	2.3	34*	222	6.2	0.6	0.79	0.23	0.80	7.1	22.05*
A.5	Max	258	–	–	–	5.4	44.0	1.00	15.00	4.88	9.1	–
	Min	16	–	–	–	1.4	0.3	0.00	0.00	0.65	4.4	–
	Avg	64	–	–	–	3.0#	6.2	0.24	0.35	1.14	6.8	–
A.6	Max	148	1.3	160	2,450	10.0	6.6	1.20	1.10	1.70	8.0	–
	Min	2	0.4	2	171	0.8	0.5	0.00	0.00	0.31	6.2	–
	Avg	52	1.0	63	382	6.5	3.3	0.28	0.11	0.78	7.0	–
A.7	Max	680	3.7	130	1,140	10.2	55.0	7.10	2.00	2.72	8.8	38.00
	Min	0	0.1	10	210	1.8	0.3	0.00	0.00	0.04	5.2	2.80
	Avg	57	1.1	49	599	7.0	5.8	0.63	0.22	0.69	7.2	8.22
A.8	Max	120	8.5	114	1,280	12.1	14.4	4.82	1.83	0.27	7.9	21.30
	Min	20	0.2	5	152	3.9	0.2	0.15	0.06	0.02	7.9	5.46
	Avg	46*	2.6*	39*	566*	6.7*	5.6*	1.45*	0.38*	0.13#	7.9#	12.91*
A.9	Max	310	11.1	43	45,900	12.8	12.0	4.24	1.27	2.10	8.5	6.90
	Min	20	0.0	5	14,000	0.3	0.7	0.00	0.00	0.00	6.7	0.70
	Avg	76	2.6	15	33,049	6.1	4.6	0.57	0.16	0.78	7.5	2.92
H.1	Max	272	33.0	160	1,580	12.5	6.0	5.00	5.20	1.50	8.3	1.20
	Min	0	0.2	0	58	1.7	0.0	0.00	0.01	0.15	6.8	0.18
	Avg	124	4.4	56	337	5.9	0.6	0.86	0.37	0.73	7.5	0.56*
H.2	Max	212	9.0	200	614	10.6	1.6	3.00	0.73	5.40	9.3	9.80
	Min	23	0.1	3	134	1.7	0.1	0.00	0.00	0.00	4.6	0.50
	Avg	97	2.9	55	305	6.1	0.5	0.20	0.10	1.27	7.3	1.80
H.3	Max	146	3.6	140	419	10.5	–	3.90	3.70	1.60	8.6	–
	Min	68	0.4	4	140	0.9	–	0.00	0.00	0.08	4.7	–
	Avg	113	1.3	50	299	4.7	–	0.48	0.18	0.73	7.3	–
H.4	Max	127	5.0	80	9,800	8.6	0.6	1.31	0.08	1.80	8.1	–
	Min	13	0.8	20	110	1.5	0.2	0.01	0.01	0.06	7.3	–
	Avg	97#	2.2+	50#	907	6.1	0.3	0.13*	0.05#	0.54*	7.8#	–
LM.1	Max	10	1.2	120	1,260	10.2	0.4	–	–	0.69	7.1	–
	Min	10	0.4	120	62	3.1	0.4	–	–	0.46	6.5	–
	Avg	10#	0.9+	120#	157	6.6	0.4#	–	–	0.58#	6.8#	–
TB.1	Max	110	6.1	48	49,000	11.1	5.0	0.32	1.20	7.80	8.7	3.70
	Min	67	0.7	3	18,800	0.0	1.0	0.00	0.00	0.26	6.5	1.00
	Avg	97*	2.7	13	36,205	5.2	2.5	0.05	0.30	0.91	8.0	1.88
TB.2	Max	112	12.1	27	64,800	10.4	2.0	1.00	1.10	2.50	8.6	1.50
	Min	82	0.1	0	17,500	2.2	0.5	0.00	0.01	0.00	7.1	0.87*
	Avg	99*	3.1	11	43,203	6.7	1.6	0.02	0.18	0.59	8.2	1.08*
TB.3	Max	117	8.2	42	55,900	14.4	1.8	0.82	0.75	1.20	8.6	5.70
	Min	77	0.1	0	18,000	0.6	0.0	0.00	0.02	0.09	6.8	0.30
	Avg	101	1.5	6	44,053	6.7	1.0	0.02	0.16	0.51	8.2	1.53

Note: To present as much information as possible from STORET data during January 1970-December 1976 and still keep the data validity in consideration, certa "average" column:

Absence of qualifier signal	The average presented is of at least 10 observations spanning a period of at least 3
*	Average of at least 10 observations not spanning a period of 3 years 'ur each station
+	Average of less than 10 observations spanning a 3-year period
#	Average of less than 10 observations spanning a period of less than 3 years.
–	No data available.

SOURCE : ADAPTED FROM TEXAS INSTRUMENTS, 1978

TABLE I.6-2

WATER QUALITY FOR PLANNING AREA, JANUARY 1970-DECEMBER 1976

Dissolved Oxygen (mg/ℓ)	Fluoride (mg/ℓ)	Nitrate-N (mg/ℓ)	Ammonia-N (mg/ℓ)	Organic-N (mg/ℓ)	pH (pH unit)	Ortho Phosphate (mg/ℓ)	Total Phosphate (mg/ℓ)	Temperature (°C)	Turbidity (JTU)	TOC (mg/ℓ)	Hardness (mg/ℓ)	Total Coliform[a] (No./100 ml)
6.6	4.6	1.00	3.70	0.70	8.1	-	-	28.0	-	-	-	-
6.6	0.5	0.00	0.00	0.56	4.4	-	-	13.3	-	-	-	-
6.6#	2.1	0.25	0.19	0.63#	7.0	-	-	22.4	-	-	-	-
8.0	44.0	3.00	1.75	1.47	9.2	68.00	-	29.0	28.0	-	111	-
8.0	0.5	0.00	0.00	0.25	5.5	1.40	-	12.0	28.0	-	111	-
8.0#	3.8	0.94	0.24	0.87	7.3	21.09	-	22.3	28.0#	-	111#	-
10.4	22.0	4.00	11.80	2.10	7.7	-	62.00	29.0	30.0	92.0	470	-
2.2	1.9	0.00	0.00	0.06	4.8	-	0.05	13.0	1.0	5.0	180	-
7.0	10.7	0.91	0.70	0.58	6.7	-	15.23	23.0	6.3	20.5	278	-
11.0	0.8	4.00	1.64	1.10	8.3	83.00	1.40	32.0	7.5	22.0	100	43,500
1.1	0.3	0.00	0.01	0.46	5.8	0.86	0.16	9.4	1.0	8.0	70	200
6.2	0.6	0.79	0.23	0.80	7.1	22.05*	0.77	22.8	3.5*	15.6	85#	5,226*
5.4	44.0	1.00	15.00	4.88	9.1	-	-	30.0	4.4	-	-	-
1.4	0.3	0.00	0.00	0.65	4.4	-	-	12.0	4.4	-	-	-
3.0#	6.2	0.24	0.35	1.14	6.8	-	-	21.7	4.4#	-	-	-
10.0	6.6	1.20	1.10	1.70	8.0	-	9.00	29.0	20.0	25.0	200	-
0.8	0.5	0.00	0.00	0.31	6.2	-	2.90	10.0	1.0	9.0	90	-
6.5	3.3	0.28	0.11	0.78	7.0	-	4.88	22.6	4.3	14.4	132	-
10.2	55.0	7.10	2.00	2.72	8.8	38.00	25.00	33.0	30.0	55.0	290	80
1.8	0.3	0.00	9.00	0.04	5.2	2.80	0.05	8.0	1.0	1.0	140	80
7.0	5.8	0.63	0.22	0.69	7.2	8.22	8.98	22.5	7.1	11.2	201	80#
12.1	14.4	4.82	1.83	0.27	7.9	21.30	-	29.0	28.0	22.0	220	21,000
3.9	0.2	0.15	0.06	0.02	7.9	5.46	-	17.0	1.0	2.0	220	100
6.7*	5.6*	1.45*	0.38*	0.13#	7.9#	12.91*	-	23.5*	4.9*	10.3*	220#	3,042*
12.8	12.0	4.24	1.27	2.10	8.5	6.90	-	31.0	14.0	24.7	4,527	56,000
0.3	0.7	0.00	0.00	0.00	6.7	0.70	-	12.2	1.0	1.2	4,313	200
6.1	4.6	0.57	0.16	0.78	7.5	2.92	-	24.5	5.1	7.9	4,420#	2,455*
12.5	6.0	5.00	5.20	1.50	8.3	1.20	1.40	34.0	15.0	50.0	180	30,800
1.7	0.0	0.00	0.01	0.15	6.8	0.18	0.16	6.7	2.0	4.0	68	200
5.9	0.6	0.86	0.37	0.73	7.5	0.56*	0.44	23.2	6.0	15.8	124	5,883
10.6	1.6	3.00	0.73	5.40	9.3	9.80	1.40	34.0	88.0	250.0	190	-
1.7	0.1	0.00	0.00	0.00	4.6	0.50	0.23	11.0	2.0	3.0	49	-
6.1	0.5	0.20	0.10	1.27	7.3	1.80	0.68	23.7	10.6	29.7	102	-
10.5	-	3.90	3.70	1.60	8.6	-	1.00	31.8	13.0	24.0	170	-
0.9	-	0.00	0.00	0.08	4.7	-	0.24	13.5	1.0	0.0	88	-
4.7	-	0.48	0.18	0.73	7.3	-	0.54	24.1	3.5	11.9	130	-
8.6	0.6	1.31	0.08	1.80	8.1	-	0.42	30.0	2,100.0	28.0	180	2,000
1.5	0.2	0.01	0.01	0.06	7.3	-	0.32	15.5	0.8	3.0	32	2,000
6.1	0.3	0.13*	0.05#	0.54*	7.8#	-	0.37#	23.6	70.6	13.9	129#	2,000#
10.2	0.4	-	-	0.69	7.1	-	-	29.0	4.0	33.0	23	-
3.1	0.4	-	-	0.46	6.5	-	-	13.0	2.8	0.0	23	-
6.6	0.4#	-	-	0.58#	6.8#	-	-	21.9	3.4#	15.4+	23#	-
.1	5.0	0.32	1.20	7.80	8.7	3.70	3.80	33.2	27.0	17.0	31,000	122,000
.0	1.0	0.00	0.00	0.26	6.5	1.00	0.74	15.5	0.0	1.0	3,440	100
.2	2.5	0.05	0.30	0.91	8.0	1.88	1.95	25.4	5.9	7.1	7,963#	5,431*
.4	2.0	1.00	1.10	2.50	8.6	1.50	1.40	33.0	24.0	26.0	4,200	6,400
.2	0.5	0.00	0.01	0.00	7.1	0.87*	0.02	15.0	0.7	0.0	1,400	100
.7	1.6	0.02	0.18	0.59	8.2	1.08*	0.64	24.6	4.6	6.2	3,475#	551*
.4	1.8	0.82	0.75	1.20	8.6	5.70	2.60	32.2	32.0	14.0	5,968	1,900
.6	0.0	0.00	0.02	0.09	6.8	0.30	0.25	12.0	0.0	0.0	4,400	2
.7	1.0	0.02	0.16	0.51	8.2	1.53	1.00	24.3	3.9	4.4	5,046*	140*

January 1970-December 1976 and still keep the data validity in consideration, certain qualifier signals are includ along with actual data values in the

average presented is of at least 10 observations spanning a period of at least 3 years during January 1970-December 1976.

age of at least 10 observations not spanning a period of 3 years for each station within the segment.

age of less than 10 observations spanning a 3-year period

age of less than 10 observations spanning a period of less than 3 years.

ata available.

NTS, 1978

TABLE I.6-3

CLASSIFICATION OF WATERS

CLASS	DESCRIPTION
I-A	Potable Water Supplies - Surface Waters
I-B	Potable and Agricultural Water Supplies and Storage - Ground Waters
II	Shellfish Propagation or Harvesting - Surface Waters
III	Recreation - Propagation and Management of Fish and Wildlife - Surface Waters
IV	Agricultural Supplies - Surface Waters
V-A	Navigation, Utility and Industrial Use - Surface Waters
V-B	Freshwater Storage and Utility and Industrial Use - Ground Waters

Source: Chapter 17-3.081, Florida Administrative Code

Reservoir Dam to Flint Creek has been designated Class I-A (Potable Water Supplies). Old Tampa Bay between the Courtney Campbell Causeway and the Howard Franklin Causeway is classified as Class II waters (Shellfish Propagation or Harvesting). The Hillsborough River within the boundaries of the Hillsborough River State Park is considered an "outstanding Florida water".

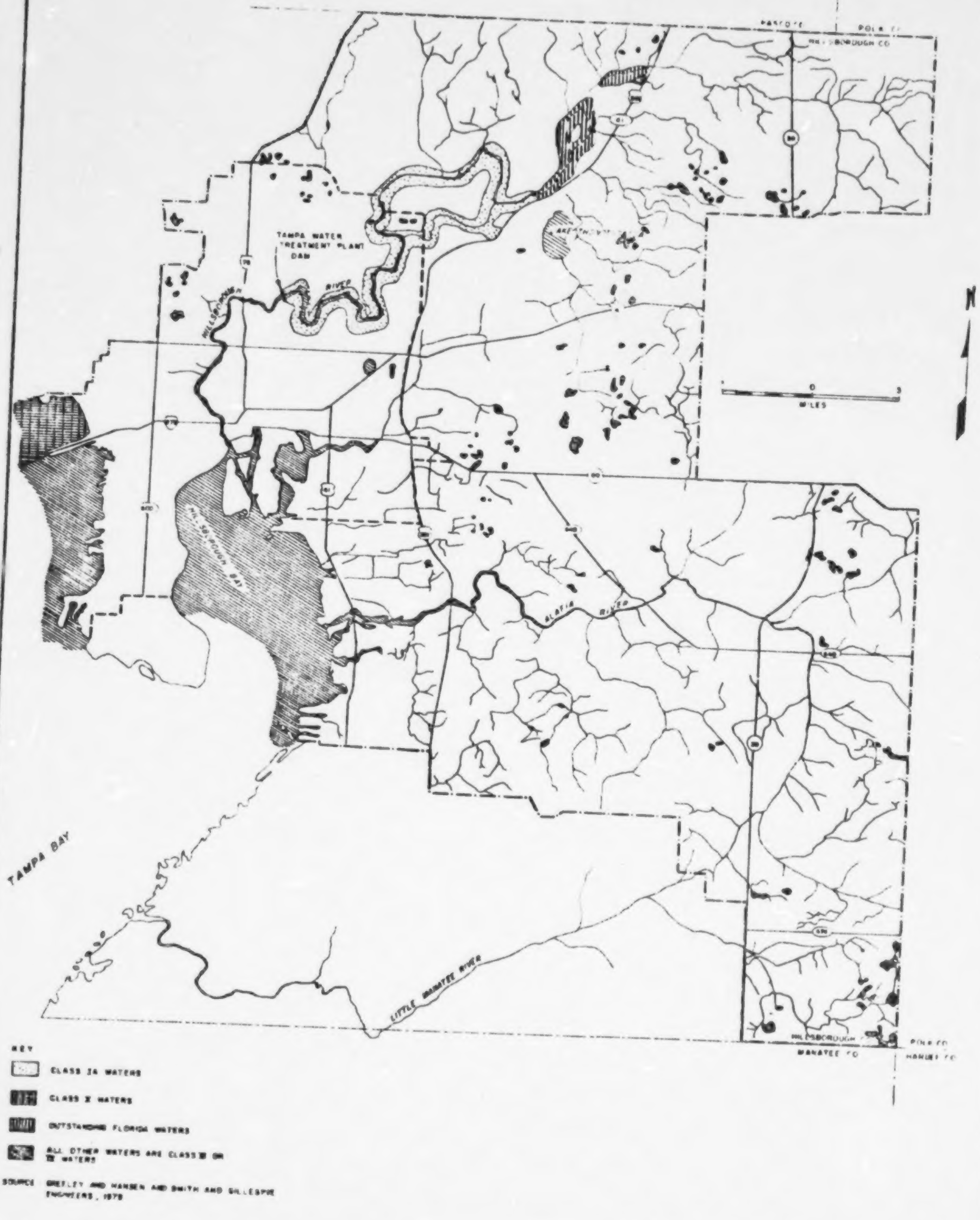
The water quality requirements of Class I-A and Class III waters are presented in Table I.6-4. Generally, all the surface waters meet their respective class requirements. However, dissolved oxygen, bacteria and mercury concentrations are frequently in violation of State standards. Lead, zinc, turbidity, pH and chromium are occasionally in violation of the standards (TBRPC, 1978a). The Areawide Water Quality Management Plan (TBRPC, 1978a) states that:

> "Given the fact that many surface waters in the region are fed by oxygen-deficient ground water and would exist in a trophically advanced state even in the absence of cultural nutrient additions, low dissolved oxygen levels are to be expected".

and

> "like dissolved oxygen, pH is another parameter whose current limits may be inappropriate for the Tampa Bay Region. The existence of large amounts of tannic and other natural acids contributes to the natural acidity of the water".

In addition to the effects of natural factors and point source discharges, non-point source discharge, in general, represents the major source of pollution in the Planning Area. A report entitled Wasteloads and Wasteload Allocations for Priority and Non-Priority Areas of the Tampa Bay Region (TBRPC, 1977) states that, as a result of increasing urbanization:


PASCO CO
POLK CO
HILLSBOROUGH CO
TAMPA WATER TREATMENT PLANT DAM
HILLSBOROUGH RIVER
LAKE THONOTOSASSA
HILLSBOROUGH BAY
ALAFIA RIVER
TAMPA BAY
LITTLE MANATEE RIVER
N
1 0 3
MILES
HILLSBOROUGH CO
MANATEE CO
POLK CO
HARDEE CO
KEY
CLASS IA WATERS
CLASS II WATERS
OUTSTANDING FLORIDA WATERS
ALL OTHER WATERS ARE CLASS III OR IV WATERS

SOURCE: GREELEY AND HANSEN AND SMITH AND GILLESPIE ENGINEERS, 1978

CENTRAL HILLSBOROUGH COUNTY-TAMPA
201 FACILITY PLAN
ENVIRONMENTAL REPORT
EPA No. C120634010

CLASSIFICATION OF SURFACE WATERS

DAMES & MOORE

FIGURE I 6-15

TABLE I.6-4

WATER QUALITY REQUIREMENTS FOR CLASS I-A

MAXIMUM LIMITS*

PARAMETER	CLASS I-A WATERS	CLASS III WATERS PREDOMINANTLY FRESH WATER**	CLASS III WATERS PREDOMINANTLY MARINE WATER***
Alkalinity ($CaCO_3$)	Not less than 20 mg/l	Not less than 20 mg/l	—
Aluminum	—	—	1.5 mg/l
Ammonia	0.02 mg/l	0.02 mg/l	—
Antimony	—	—	0.2 mg/l
Arsenic	0.05 mg/l	0.05 mg/l	0.05 mg/l
Barium	1 mg/l	—	—
Beryllium	0.011 mg/l in waters with hardness less than 150 mg/l $CaCO_3$. 1.10 mg/l for harder waters	0.011 mg/l in waters with hardness less than 150 mg/l $CaCO_3$. 1.10 mg/l for harder waters	—
BOD	Shall not be increased to exceed values which would cause dissolved oxygen to be depressed below the limit established for each class.		
Bromine	—	—	0.1 mg/l
Bromates	—	—	100 mg/l
Cadmium	0.8 ug/l in waters with hardness less than 150 mg/l $CaCO_3$ 1.2 ug/l otherwise.	0.8 ug/l in waters with hardness less than 150 mg/l $CaCO_3$ 1.2 ug/l otherwise.	5.0 ug/l
Chloride	250 mg/l	—	Not increase more than 10% over natural background.
Chlorine (total residual)	0.01 mg/l	0.01 mg/l	0.01 mg/l
Chromium	0.05 mg/l	0.05 mg/l	0.05 mg/l
Coliforms (Total)	1000/100 ml (monthly average) 2400/100 ml (anytime)	1000/100 ml (monthly average) 2400/100 ml (anytime)	1000/100 ml (monthly average) 2400/100 ml (anytime)
Copper	30 ug/l	0 3 mg/l	0.015 mg/l
Cyanide	5.0 ug/l	5.0 ug/l	5.0 ug/l
Detergents	0.5 mg/l	0.5 mg/l	0.5 mg/l
Dissolved Oxygen	Not less than 5 mg/l	Not less than 5 mg/l	Not less than 5 mg/l (24 hour average) Not less than 4 mg/l (anytime)
Dissolved Solids	500 mg/l (monthly avg.) 1000 mg/l (anytime)		
Fluorides (F)	1.5 mg/l	10.0 mg/l	5.0 mg/l
Iron	0.3 mg/l	1.0 mg/l	0.3 mg/l
Lead	0.03 mg/l	0.03 mg/l	0.05 mg/l
Mercury	0.2 ug/l	0.2 ug/l	0.1 ug/l
Nickel	0.1 mg/l	0.1 mg/l	0.1 mg/l
Nitrate (N)	10 mg/l	—	—
Nutrients	In no case shall nutrient concentrations of a body of water be altered so as to cause an inbalance in natural populations of aquatic flora or fauna.		
Oils & Grease	5.0 mg/l	5.0 mg/l	5.0 mg/l

Pestici
Aldrin
Chlor
DDT
Demet
Endos
Endrin
Guthio
Hepta
Lindan
Malat
Metho
Mirex
Parat
Toxap
2-4-D
2,4,5
pH
Phenol
Phosp
tal)
Phtha
Polyc
Biph
Radiu
Gross
Selen
Silve
Turbi
Zinc

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*** "Pred
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mg/l =
ug/l =

SOURCE: CHAPTER 17-3, FLORIDA ADMINISTRATIVE CODE

TABLE I.6-4

WATER QUALITY REQUIREMENTS FOR CLASS I-A & III WATERS

MAXIMUM LIMITS*

	CLASS III WATERS PREDOMINANTLY FRESH WATER**	PREDOMINANTLY MARINE WATER***
	Not less than 20 mg/l	—
	—	1.5 mg/l
	0.02 mg/l	—
	—	0.2 mg/l
	0.05 mg/l	0.05 mg/l
	—	—
in waters ss less /l $CaCO_3$. r harder	0.011 mg/l in waters with hardness less than 150 mg/l $CaCO_3$. 1.10 mg/l for harder waters	—

increased to exceed values which would cause dissolved
depressed below the limit established for each class.

	—	0.1 mg/l
	—	100 mg/l
waters ss less /l $CaCO_3$ erwise.	0.8 ug/l in waters with hardness less than 150 mg/l $CaCO_3$ 1.2 ug/l otherwise.	5.0 ug/l
	—	Not increase more than 10% over natural background.
	0.01 mg/l	0.01 mg/l
	0.05 mg/l	0.05 mg/l
(monthly (anytime)	1000/100 ml (monthly average) 2400/100 ml (anytime)	1000/100 ml (monthly average) 2400/100 ml (anytime)
	0 3 mg/l	0.015 mg/l
	5.0 ug/l	5.0 ug/l
	0.5 mg/l	0.5 mg/l
5 mg/l	Not less than 5 mg/l	Not less than 5 mg/l (24 hour average) Not less than 4 mg/l (anytime)
thly avg.) ytime)		
	10.0 mg/l	5.0 mg/l
	1.0 mg/l	0.3 mg/l
	0.03 mg/l	0.05 mg/l
	0.2 ug/l	0.1 ug/l
	0.1 mg/l	0.1 mg/l
	—	—

hall nutrient concentrations of a body of water be altered
se an inbalance in natural populations of aquatic flora

	5.0 mg/l	5.0 mg/l

MAXIMUM LIMITS*

PARAMETER	CLASS I-A WATERS	CLASS PREDOMINANTLY FRES WATER***
Pesticides & Herbicides		
Aldrin plus Dieldrin	0.003 ug/l	0.003 ug/l
Chlordane	0.001 ug/l	0.01 ug/l
DDT	0.001 ug/l	0.001 ug/l
Demeton	0.1 ug/l	0.1 ug/l.
Endosulfan	0.003 ug/l	0.003 ug/l
Endrin	0.004 ug/l	0.004 ug/l
Guthion	0.01 ug/l	0.01 ug/l
Heptachlor	0.001 ug/l	0.001 ug/l
Lindane	0.01 ug/l	0.01 ug/l
Malathion	0.1 ug/l	0.1 ug/l
Methoxychlor	0.03 ug/l	0.03 ug/l
Mirex	0.001 ug/l	0.001 ug/l
Parathion	0.04 ug/l	0.04 ug/l
Toxaphene	0.005 ug/l	0.005 ug/l
2-4-D	100 ug/l	—
2,4,5-TP	10 ug/l	—
pH	Not less than 6.0 Not more than 8.5	Not less than 6.0 Not more than 8.5
Phenolic Compounds	1.0 ug/l	1.0 ug/l
Phospherous (Elemental)	—	—
Phthalate Esters	3.0 ug/l	3.0 ug/l
Polychlorinated Biphenyls	0.001 ug/l	0.001 ug/l
Radium - 226, 228	5 picocuries/l	5 picocuries/l
Gross Alpha	15 picocuries/l	15 picocuries/l
Selenium	0.01 mg/l	0.025 mg/l
Silver	0.07 ug/l	0.07 ug/l
Turbidity	50 Jackson Units above natural background	50 Jackson Units above natural back ground
Zinc	0.03 mg/l	0.03 mg/l

* Unless otherwise noted - violations of these criteria constitute pollution.

** "Predominantly Fresh Waters" means those surface waters in which the specific conductance of the water at the surface is less than 5,000 micromhos per centimeter.

*** "Predominantly Marine Waters" means those surface waters in which the specific conductance of the water at the surface is greater than or equal to 5,000 micromhos per centimeter.

mg/l = milligrams per liter.
ug/l = micrograms per liter.

.6-4

CLASS I-A & III WATERS

MAXIMUM LIMITS*

PARAMETER	CLASS I-A WATERS	CLASS III WATERS PREDOMINANTLY FRESH WATER***	CLASS III WATERS PREDOMINANTLY MARINE WATER***
Pesticides & Herbicides			
Aldrin plus Dieldrin	0.003 ug/l	0.003 ug/l	0.003 ug/l
Chlordane	0.001 ug/l	0.01 ug/l	0.004 ug/l
DDT	0.001 ug/l	0.001 ug/l	0.001 ug/l
Demeton	0.1 ug/l	0.1 ug/l,	0.01 ug/l
Endosulfan	0.003 ug/l	0.003 ug/l	0.001 ug/l
Endrin	0.004 ug/l	0.004 ug/l	0.004 ug/l
Guthion	0.01 ug/l	0.01 ug/l	0.01 ug/l
Heptachlor	0.001 ug/l	0.001 ug/l	0.001 ug/l
Lindane	0.01 ug/l	0.01 ug/l	0.04 ug/l
Malathion	0.1 ug/l	0.1 ug/l	0.1 ug/l
Methoxychlor	0.03 ug/l	0.03 ug/l	0.03 ug/l
Mirex	0.001 ug/l	0.001 ug/l	0.001 ug/l
Parathion	0.04 ug/l	0.04 ug/l	0.04 ug/l
Toxaphene	0.005 ug/l	0.005 ug/l	0.005 ug/l
2-4-D	100 ug/l	—	—
2,4,5-TP	10 ug/l	—	—
pH	Not less than 6.0 Not more than 8.5	Not less than 6.0 Not more than 8.5	Not less than 6.5 Nor more than 8.5
Phenolic Compounds	1.0 ug/l	1.0 ug/l	1.0 ug/l
Phospherous (Elemental)	—	—	0.1 ug/l
Phthalate Esters	3.0 ug/l	3.0 ug/l	—
Polychlorinated Biphenyls	0.001 ug/l	0.001 ug/l	0.001 ug/l
Radium - 226, 228	5 picocuries/l	5 picocuries/l	5 picocuries/l
Gross Alpha	15 picocuries/l	15 picocuries/l	15 picocuries/l
Selenium	0.01 mg/l	0.025 mg/l	0.025 mg/l
Silver	0.07 ug/l	0.07 ug/l	0.05 ug/l
Turbidity	50 Jackson Units above natural background	50 Jackson Units above natural background	50 Jackson Units above natural background
Zinc	0.03 mg/l	0.03 mg/l	1.0 mg/l

* Unless otherwise noted - violations of these criteria constitute pollution.

** "Predominantly Fresh Waters" means those surface waters in which the specific conductance of the water at the surface is less than 5,000 micromhos per centimeter.

*** "Predominantly Marine Waters" means those surface waters in which the specific conductance of the water at the surface is greater than or equal to 5,000 micromhos per centimeter.

mg/l = milligrams per liter.
ug/l = micrograms per liter.

> "...., the nonpoint pollutant wasteloads are, in general, increasing. Existing water quality data verifies this trend of decreasing water quality as a result of urbanization".

All stream segments within the Tampa Bay Region (including the Planning Area) have been classified by the Areawide Water Quality Management Plan (AWQM Plan) for the Tampa Region as water quality limited (TBRPC, 1978a). This classification means that application of best practicable treatment for industrial discharges and secondary treatment for domestic dischargers is insufficient to achieve acceptable water quality. As a result, the AWQM Plan concluded that "..., nonpoint sources must be contributing a significant portion of the pollution problem" (TBRPC, 1978a).

Bays - Surface water runoff from the Tampa urban area is collected by storm sewers to over 60 inches in diameter and discharged to Hillsborough Bay, Old Tampa Bay and McKay Bay. In addition, industrial and municipal wastewater is discharged directly to the Tampa Bay system. A list of industrial and domestic wastewater dischargers in the Planning Area, effluent characteristics and receiving water bodies are presented in Table I.6-5 and I.6-6. Locations of the discharges are shown on Figures I.6-16 and I.6-17.

Data collected during 1970-1976 indicates that some of the poorest water quality exists in upper Hillsborough Bay (Table I.6-2). Hillsborough Bay (TB-1) is observed to be higher in color, fluoride, nitrate-N, ammonia-N, organic-N, orthophosphate, total phosphate, turbidity, total organic carbon, hardness and coliform bacteria and lower in dissolved oxygen and pH than either Old Tampa Bay (TB-2) or Tampa Bay proper (TB-3) (Table I.6-2).

A study performed by the Florida Water Pollution Control Administration in 1969 showed that the single greatest contributor of 5-day BOD, total dissolved solids, ammonia nitrogen and total Kjeldahl nitrogen

TABLE I.6-5

INDUSTRIAL POINT-SOURCE DICHARGES

Location No.	Discharger	Design Capacity (mgd)	Average Daily Flow (mgd)	Loading in Discharge (lb/day)					Primary Receiving Waters
				BOD 5	Suspended Solids	Total Nitrogen	Total Phosphorus	Ultimate Oxygen Demand	
1	Union Oil Company	NPDES: Daily maximum oil and grease = 10 mg/l							Hillsborough Bay
2	Murphy Oil Co.	NPDES: Average daily oil and grease = 10 mg/l							Hillsborough Bay
3	S.T. Triangali Co.	Shrimp processing wastewater							Hillsborough Bay
4	Sulphur Terminals Co. Inc.	Boiler blowdown, noncontact cooling water, waste condensate, and treated domestic wastewater							Sparkman Channel
5	Superior Seafoods, Inc.	Shrimp processing							Hillsborough Bay
6	General Portland Inc.	Air compressor cooling water 137 mg/l							Ybor Channel
7	American Petrofina Co. of Texas	NPDES: Average daily oil and grease = 10 mg/l							Ditch to Sparkman Channel
8	Tampa Electric (Hookers Point Station)	-	513	-		-	-	-	Sparkman Channel
	Discharge #1	-	-	-	720.0	-	-	-	Sparkman Channel
	Discharge #2	-	-	-	50.0	-	-	-	Sparkman Channel
	Discharge #3	-	-	-	120.0	-	-	-	Sparkman Channel
	Discharge #4	-	-	-	-	-	-	-	Sparkman Channel
9	Cities Service Oil Company	NPDES: Average daily oil and grease = 10 mg/l							Drainage ditch to Hillsborough Bay
10	Texaco, Inc.	NPDES: Daily maximum oil and grease = 10 mg/l							Sparkman Channel
11	American Oil Co. (terminal)	0.10	-	NPDES: Average daily oil and grease = 10 mg/l; pH = 6.0-8.5					Sparkman Channel
12	Ideal Cement Co.	NPDES: Average daily temperature = 95°F							Hillsborough Bay
13	International Minerals & Chemical Company (IMC)	Cooling water discharge							Hillsborough Bay
14	Tampa Electric Co. (Gannon Sta.)	-	1279.7	Once-through cooling water, low volume waste sources, metal cleaning waste boiler blowdown, ash pond overflows, material storage, and construction runoff					Hillsborough Bay
15	W.R. Grace & Co.	-	1.44	Average winter temperature = 76°F, Summer = 81°F					Hillsborough Bay
16	Nitram Chemicals, Inc.	-	0.44	-	-	395	-	-	Delaney Creek
17	Tampa Municipal Incinerator	5.0	3.4	40.4	93.8	-	-	-	McKay Bay
18	American Can Co.	Cooling water discharge							Storm drain to Sparkman Channel
19	Del Monte Corp.	0.08	-	NPDES: Average daily temperature = 95°F					City drainage to McKay Bay
20	Union Carbide								
21	Davies Can Co.	NPDES: Daily average temperature = 95°F							Ditch to McKay Bay
22	Seaboard Coastline	0.325	-	Oil skimmer waste discharged during excessive rainfall					Creek to McKay Bay
23	Redwing Carriers, Inc.	0.01	-	30.0	Suspended solids = 30 mg/l; BOD_5 = 30 mg/l				Creek to McKay Bay

TABLE I.6-5 (CONTINUED)

Location No.	Discharger	Design Capacity (mgd)	Average Daily Flow (mgd)	Loading in Discharge (lb/day)					Primary Receiving Waters
				BOD_5	Suspended Solids	Total Nitrogen	Total Phosphorus	Ultimate Oxygen Demand	
24	Compomar Modern Dairies	Dairy process water; infrequent discharge							Delaney Creek to Hillsborough Bay
25	Kaiser Agricultural Chem. Co.	-	0.04	-	11.5	211.0	-	-	Delaney Creek
26	M&T Chemicals, Inc.	-	0.001	0.6	Contaminants: iron, cyanide copper, lead, zinc				Ditch to McKay Bay
27	Treasure Isle Inc. (Ocean Products)	0.75	-	31.2	37.6	84.7	109.9	-	Onsite lake to Hillsborough River
28	C.F. Industries	-	-	-	264.0	61.0	90.0	-	Hillsborough River
29	Florida Agglite	-	3.7	Average total suspended solids = 28 m/1; total phosphate = 2.8 mg/l					Ditches to Alafia River
30	IMC	-	5.3	-	755.0	27.0	13.0	-	South prong, Alafia River
31	Brewster Phosphates	-	-	-	-	-	-	-	Emergency discharge to ditch to Alafia River
32	Borden, Inc. (Chemical Div.)	Contaminated rainwater (80 mg/l) discharged from setting pond during >10-year 24-hour chronic rainfall event if waste setting pond is full							South prong, Alafia River
33	Tampa Electric (Big Bend Sta.)	-	1036	Treated boiler blowdown and untreated stormwater runoff					Canal to Tampa Bay
34	Gibsonton Speed Wash	0.02	-	Trickling filter wastewater					Ditch to Alafia River
35	Gardinier, Inc.	55.4	33.8	-	3849.0	416.0	1215.0		Alafia River
36	Spring Valley Dairies, Inc.	-	-	NPDES: Effective June 30, 1976, retain all process wastewaters plus 5 inches of rainfall from 24-hour incident					Bell Creek to Alafia River
37	Anheuser Busch	Cooling water is recycled and discharged with stormwater							Ditch to Hillsborough River
38	Mcgraw-Edison Power	Cooling water discharge							Hillsborough River
39	Bear Plaza Koin Kleen Laundry	0.005	-	Laundry wastewater overflow during excessive rainfall					Lake with no outfall
40	Honeywell, Inc.	0.57	0.38	Cooling water discharge					Barrow Pit to canal to Sweetwater Creek
41	National Papaya	-	0.001	Bottle wash water					Drainage ditch to Old Tampa Bay
42	U.S. Army Reserve Center	Discharge during excessive rainfall only							Tampa storm sewers
43	Gulf Gold (Seabrook Foods, Inc.)	-	0.1	260.0	111.3	30.14	-	-	Hillsborough Bay
44	Shell Oil Co.	Intermittent stormwater discharge							Tampa Bay
45	Winn Dixie Stores, Inc.	NPDES: Average daily temperature = 95°F							Hillsborough River
46	Ralston Purina	Boiler blowdown							McKay Bay
47	Rawlins Fish Farm	-	-	Fish culturing ponds overflow					Ditch to Alafia River
48	Scalare Hatchery	Fish culturing ponds overflow							Ditch to Bullfrog Creek
	Millard's Laundry	0.004	0.003	0.98	2.05	-	-	-	Alafia River to Tampa Bay

LOCATION NUMBERS ARE KEYED TO FIGURE 3-38.

SOURCE : SHAW, A.J. AND WILLIAMS, R.G., 1978
TEXAS INSTRUMENTS, 1978 and FDER,1979d

TABLE I.6-6

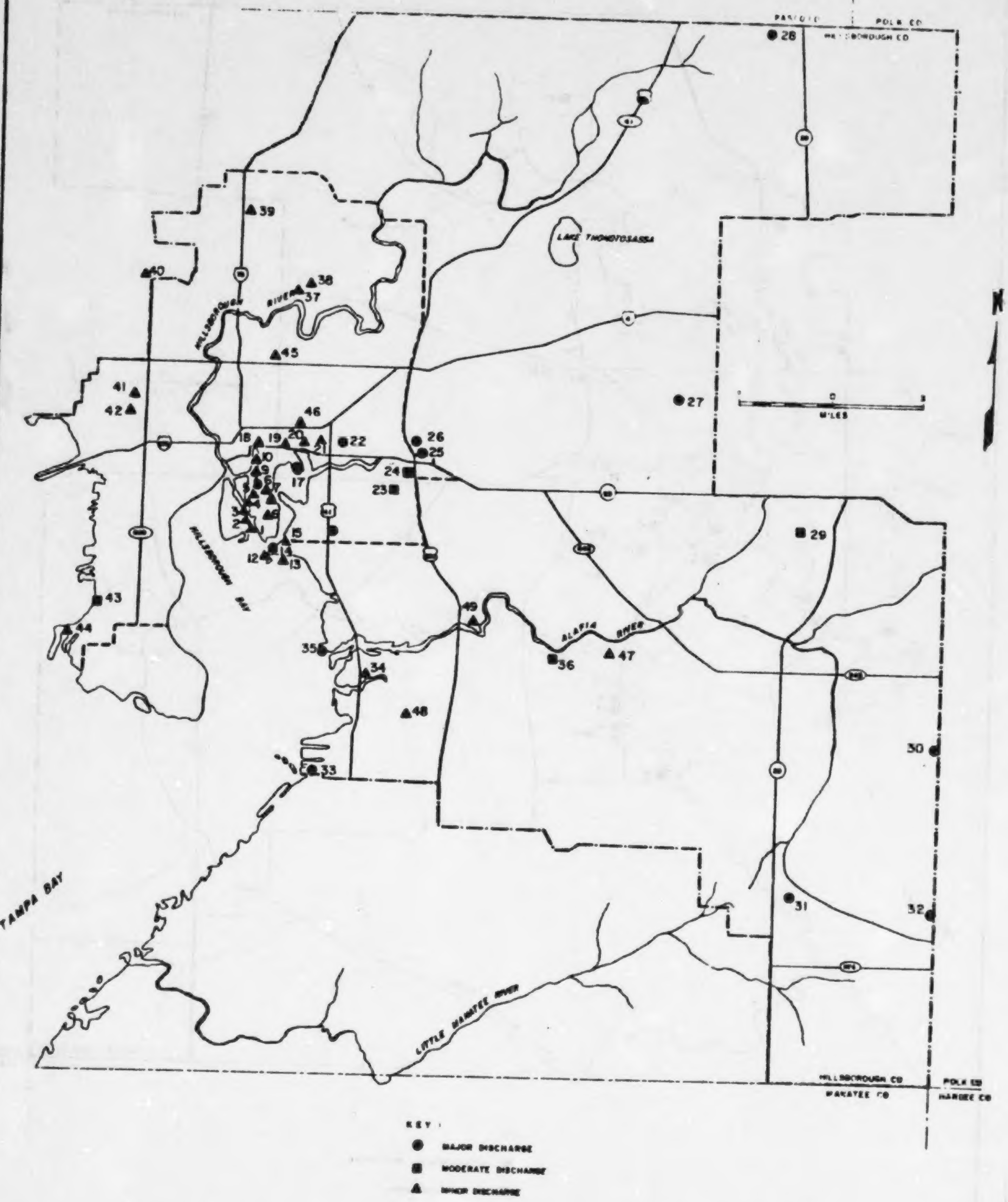
DOMESTIC POINT-SOURCE DISCHARGES

Location No.	Discharger	Design Capacity (mgd)	Average Daily Flow (mgd)	Loading in Discharge (lb/day) BOD 5	Suspended Solids	Total Nitrogen	Total Phosphorus	Ultimate Oxygen Demand	Primary Receiving Waters
1	City of Tampa * Hookers Point	60.0	44.8	3736	2092	1607	710	-	Hillsborough Bay
2	City of Tampa Juanita Apts.	0.01	0.0035	0.1	0.2	0.6	0.2	2.8	Tampa Bay
3	Tampa Yacht Club	0.005	0.005	0.8	0.8	0.8	0.3	4.8	Hillsborough Bay
4	Adamo Acres	0.272	0.09	45.9	31.3	15.0	4.5	127.7	Canal to Palm River
5	East Lake Park	0.25	0.28	11.9	21.7	46.7	14	228.8	EPP to Palm River
6	Hazard MHP	0.0035	0.003	0.70	0.57	0.5	0.2	3.2	McKay Bay
7	Progress Village	0.25	0.25	213.7	146.6	41.7	12.5	465.6	Canal to Hillsborough Bay
8	TECO - Gannon	0.0045	0.003	0.4	0.51	0.5	0.2	2.8	Hillsborough Bay
9	Williams U.S. 301 Truck Stop	0.0125	0.004	0.4	0.3		0.2	3.6	Pol. pond to McKay Bay
10	Gardinier, Inc.	0.012	0.006	0.12	0.165	1.0	0.3	4.7	Alafia River
11	TECO - Big Bend	0.0045	0.003	0.31	0.4	0.5	0.15	2.7	Tampa Bay
12	Eastwood Est. MHP	0.03	0.007	0.3	0.4	1.2	0.4	5.7	Bullfrog Creek
13	Alafia MHP	0.02	0.0065	0.39	0.36	1.1	0.3	5.5	Bullfrog Creek to Tampa Bay
14	Nistai TP	Not discharging							
15	Twin Oaks Plaza	.015	.005	45.0	14.6				Storm drainage swamp to Bullfrog Creek
16	Honeywell #1	0.1	0.025	23.0	2.4	-	1.3	22.0	Pond to Sweetwater Creek
17	Branch Ranch Restaurant	.003	-	-	-	-	-	-	EPP
18	Bullfrog Creek MHP	.01	.0075	5.0	5.0				EPP
19	Connrey Corp.								
20	Hillsborough Utilities Corp.								
21	Lakewood Estates	.175	.130	13.1	7.6				EPP
22	Nitram Inc.	.005	.002	11.2	13.7				Drainage canal to Delaney Creek
23	Pebble Creek Village	.1	.008	7.1	9.4				IRR
24	Steak & Ale	0.01	0.003	0.1	0.1	0.1	0.1	0.2	Sweetwater Creek

LOCATION NUMBERS KEYED TO FIGURE 3-38A

SOURCE : SHAW, A.J. AND WILKINS, R.G., 1978
TEXAS INSTRUMENTS, 1978 AND FDER, 1979d

* BASED ON DER MONTHLY OPERATING REPORTS JAN 1979 - JULY 1979


PASCO CO
POLK CO
HILLSBOROUGH CO
28
LAKE THONOTOSASSA
N
MILES
39
40
38
37
HILLSBOROUGH RIVER
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HILLSBOROUGH BAY
15
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14
13
29
43
44
49
ALAFIA RIVER
35
36
47
34
48
30
33
TAMPA BAY
31
32
LITTLE MANATEE RIVER
HILLSBOROUGH CO
POLK CO
MANATEE CO
HARDEE CO
KEY:
● MAJOR DISCHARGE
■ MODERATE DISCHARGE
▲ MINOR DISCHARGE

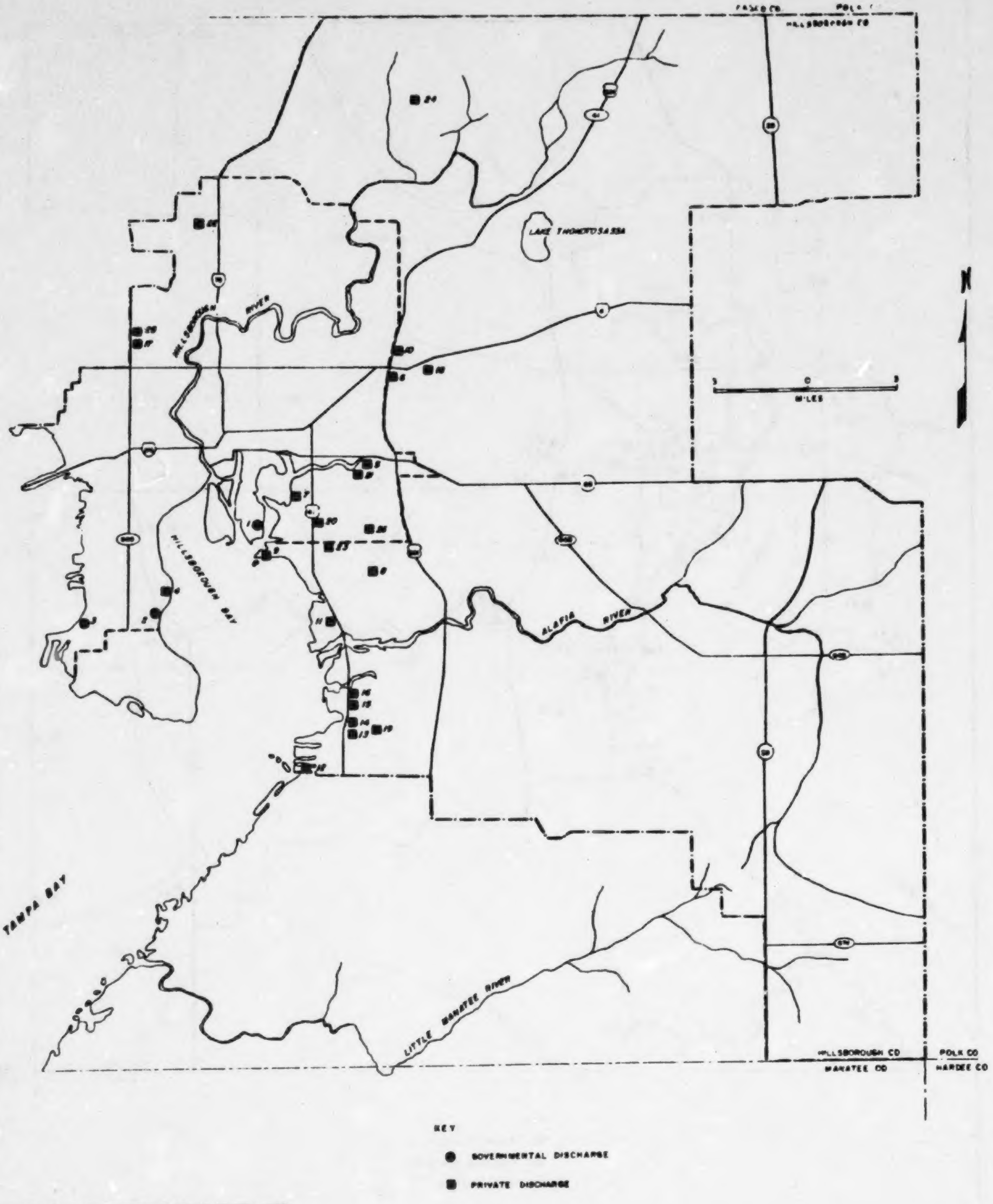
SOURCE SHAW, A.J. AND WILKINS, R.G., 1978

CENTRAL HILLSBOROUGH COUNTY-TAMPA
201 FACILITY PLAN
ENVIRONMENTAL REPORT
EPA No C120634010

SOURCES OF INDUSTRIAL WASTEWATER DISCHARGE

DAMES & MOORE

FIGURE I.6-16


PASCO CO
POLK CO
HILLSBOROUGH CO
LAKE THONOTOSASSA
HILLSBOROUGH RIVER
HILLSBOROUGH BAY
ALAFIA RIVER
TAMPA BAY
LITTLE MANATEE RIVER
MILES
HILLSBOROUGH CO
POLK CO
MANATEE CO
HARDEE CO
7
1
11
16
15
14
13
KEY
● GOVERNMENTAL DISCHARGE
■ PRIVATE DISCHARGE

SOURCE · TAMPA BAY REGIONAL PLANNING COUNCIL, 1977c
SHAW, A.J. AND WILKENS, R.S., 1978

LOCATION OF DOMESTIC WASTEWATER SOURCES AND DISCHARGES TO SURFACE WATER BODIES

CENTRAL HILLSBOROUGH COUNTY · TAMPA
201 FACILITY PLAN
ENVIRONMENTAL REPORT
EPA No C120634010

T65501028 (2/79)

DAMES & MOORE

FIGURE I.6-17

was the discharge of primary-treated wastewater from the Tampa sewage treatment plant at Hookers Point (FWPCA, 1969). At the time of the FWPCA study, the plant's discharge produced a major drain on the oxygen resources of Hillsborough Bay.

However, since the FWPCA study, the Hookers Point sewage treatment plant has progressed from primary treatment to secondary (January 1977), and from secondary treatment to advanced wastewater treatment (AWT) (January 1979). A comparison of effluent wasteloads presented in the FWPCA study versus those calculated from operating and process reports for the period January 1979 through July 1979 show that, although the average daily wastewater flow has increased approximately 160 percent, 5 day BOD loads decreased approximately 92 percent, nitrogen (as ammonia) loads decreased approximately 95 percent, Kjeldahl nitrogen loads decreased approximately 84 percent and total phosphate loads decreased approximately 74 percent.

A marked decrease in the phosphorus levels in the Tampa Bay System occurred in 1975 and this trend continued in 1976 (Ross and Jerkins, 1978). However, phosphate concentrations observed in 1977 and 1978 indicate a possible leveling-off in the decreasing trend (Shaw and Wilkins, 1979). This decrease in phosphate levels is attributed to severe restrictions placed by the Florida Department of Environmental Regulation on the amounts of phosphate discharged by the phosphate industries along the Alafia River (Ross and Jerkins, 1978).

Nitrogen levels in the Tampa Bay System have also improved in recent years due to state limitations placed on nitrogen discharges (Ross and Jerkins, 1978). The total Kjeldahl nitrogen concentration, which is frequently used as an indicator of sewage and industrial waste pollution, decreased considerably during 1978 (Shaw and Wilkins, 1979).

Changes in the water quality of Hillsborough Bay as a result of the implementation of Advance Wastewater Treatment at the Hookers Point sewage treatment plant and other reductions in point source discharges will probably not be observed for several years due to the poor flushing of the Bay. In addition, such improvements in water quality will probably be affected by the dredging in Hillsborough and Tampa Bays.

Water in McKay Bay is also of poorer quality than the open areas of Tampa Bay (TBRPC, 1977c). Dissolved oxygen normally reaches supersaturation at the surface but remains below 4 mg/l at the bottom. Chlorophyll-a concentrations are high. Average phosphate concentrations are more than double open Tampa Bay concentrations. BOD concentrations range between 2 and 6 mg/l and average 4 mg/l. Low oxygen levels could result from the high levels of chlorophyll, nutrients and BOD in parts of McKay Bay (Texas Instruments, 1978).

Old Tampa Bay has better water quality than Hillsborough Bay, but worse than Tampa Bay proper. Bacteria concentrations, BOD and nutrient concentrations are contributed by several Hillsborough County sewage treatment plants which discharge directly to the Bay.

During 1978, water quality throughout Hillsborough Bay and McKay Bay was undesirable. Swimming was unsafe for 7 or more months in Hillsborough Bay near Davis Islands. McKay Bay and the remaining majority of Hillsborough Bay were unsafe for swimming 5 of 6 months of 1977. Most of the rest of Tampa Bay was unsafe for swimming 1 or 2 months of the year (Shaw, A.J. and Wilkins, R.G., 1979).

During 1979, McKay Bay and Hillsborough Bay were considered hazardous for shellfish harvesting for 7 or more months. Most of the rest of the Tampa Bay Basin was hazardous for 5 or more months of the year (Shaw, A.J. and Wilkins, R.G., 1979).

Hillsborough River Basin - The Hillsborough River discharges an estimated average daily load of 950 pounds of nitrogen, 630 pounds of phosphate and 3300 pounds of BOD to Hillsborough Bay. The highly urbanized area of Tampa and Temple Terrace discharge storm sewer flows directly to the Hillsborough River. Domestic and industrial discharges to the Hillsborough River are identified in Table I.6-5 and Table I.6-6.

Extensive sampling of the Hillsborough River has been conducted at Fowler Avenue. Dissolved oxygen is frequently below 5 mg/l and as low as 1 mg/l in the morning. BOD is also generally low. Nitrate and orthophosphate nutrients are moderately high. Total coliforms are often high. Fecal contamination is attributed to livestock sources. Nutrient and organic concentrations reflect water quality conditions throughout the upstream drainage area (TBRPC, 1977a).

The river at Fowler Avenue also has neutral to slightly alkaline pH, low turbidity, moderate color and moderately high conductivity. No problems exist with arsenic, cadmium, lead, copper, nickel and zinc. However, mercury is reported to exceed EPA criteria (TBRPC, 1977a).

Extensive sampling of the Hillsborough River downstream of Blackwater Creek indicates that river flow, except during periods of very high discharge, is largely made up of inflows from the artesian aquifer (Crystal Springs) or the water table aquifer. Very high levels of nitrate and phosphorous have been reported and may be associated with natural ground water characteristics as well as livestock waste loading and fertilizer runoff. Dissolved oxygen levels are generally 4 to 6 mg/l at midday but occasionally reach supersaturation (10 to 12 mg/l depending on water temperature). Excessive fecal contamination may occur occasionally.

No concentrations in excess of applicable criteria for arsenic, cadmium, chromium, copper, nickel and zinc were reported. However, lead and mercury concentrations have exceeded state water quality criteria (TBRPC, 1977a).

Table I.6-7 presents summaries of water quality for the major tributaries in the Hillsborough River Basin within the Planning Area.

Wasteload allocation studies performed for the lower Hillsborough River indicate that nonpoint waste loads contribute the majority of the pollution load to the River. In the portion of the river closest to the Tampa Reservoir, urban runoff from the areas of north Tampa and Temple Terrace is the most significant contributor of nonpoint source loadings (TBRPC, 1977).

In order to maintain dissolved oxygen levels of 5.0 mg/l in the lower Hillsborough River, the average wet season daily nonpoint source loads must be reduced by sixty (60) percent (TBRPC, 1977).

Alafia River Basin - The Alafia River Basin drains the phosphate mining area of central Hillsborough and western Polk Counties. As a result, the Alafia River and many of its tributaries contain some of the highest fluoride and phosphate concentrations in the Planning Area. Natural leaching of soil and rock rich in phosphate and runoff from fertilized land contributes to the high phosphate concentrations (Texas Instruments, 1978).

Nitrogen (as ammonia) concentrations can be very high in some segments of the Alafia River Basin due largely to the increased production of ammonia and fertilizers in recent years (Texas Instruments, 1978).

Fecal contamination is a local problem in the basin caused by septic tank drainage and discharge of improperly treated sewage effluent (Texas Instruments, 1978). Large sections of the Alafia River are often posted by the Hillsborough County Health Department to warn against swimming because of high coliform concentrations (Dames & Moore, 1975).

TABLE I.6-7

WATER QUALITY CHARACTERISTICS OF HILLSBOROUGH RIVER TRIBUTARIES

STREAM	TRIBUTARY TO	WATER QUALITY CHARACTERISTICS	COMMENTS
Itchepackesassa Creek	Blackwater Creek	High BOD High nutrients High indicator bacteria	Water quality better during dry season. Pollution attributed to runoff from feedlots and improved pasture and direct livestock access to creek and tributaries(TBRPC).
Blackwater Creek	Hillsborough River	High nitrate High indicator bacteria Very high orthophosphate Moderately high BOD Moderately low dissolved oxygen	Water quality the same or slightly improved from Itchepackesassa Creek. Orthophosphate levels may be natural for area. Concluded that "sources in the Itchepackesassa basin, possibly as far south as Plant City, may be contributing to the largest portion of organic and nutrient loading to the Blackwater Creek basin."
New River	Hillsborough River	Low dissolved oxygen High indicator bacteria High suspended solids High ammonia Low nitrate/nitrite	Land use suggest fecal contamination caused by livestock sources. Low oxygen levels are associated with stream channelization and aquatic weed buildup and not organic loading.
Trout Creek	Hillsborough River	Moderate to low dissolved oxygen Moderate to low BOD Moderate to low nutrients Moderately high indicator bacteria	Depressed oxygen levels associated with poor airation of stream channel due to stagnation, channel depth and/or plant cover. Fecal contamination attributed to livestock sources.
Two Hole Branch	Hillsborough River	High orthophosphate High ammonia High BOD Low dissolved oxygen High indicator bacteria	Water quality indicates severe fecal contamination by livestock, most likely by direct livestock access to stream. Phosphorous levels may be natural background concentrations.
Cypress Creek	Hillsborough River	Low dissolved oxygen Low BOD Moderately high orthophosphate Moderately high nitrate Moderate indicator bacteria	Some fecal contamination from livestock occurs but problem is not severe. Low dissolved oxygen is probably associated with the natural swamp environment.
Baker Creek	Lake Thonotosassa	Moderately low dissolved oxygen Moderately low BOD High nutrients (especially nitrates) High indicator bacteria	Fecal contamination caused by livestock source. Low oxygen attributed to stream channelization and/or aquatic plant buildup. High nutrients associated with point sources at Plant City and agricultural nonpoint sources. The Plant City Advanced Wastewater Treatment Plant discharges 2.6 MGD containing an average of 3 mg/l BOD and suspended solids to Mill Creek (a tributary to Baker Creek). Florida Sip, Inc. discharges 2 MGD containing a maximum of 20 mg/l BOD to Mill Creek. These discharges constitute a serious threat to water quality due to the volume of waste and low natural base flows.
Hollomans Branch	Hillsborough River	Moderate dissolved oxygen Low BOD High orthophosphate High indicator bacteria	Fecal contamination attributed to livestock source. Orthophosphate may be caused by natural background phosphorous levels.

Source : TBRPC, 1977a

Table I.6-8 presents summaries of water quality for the major tributaries in the Alafia River Basin within the Planning Area. Generally, the nonpoint sources of pollution are not of as great a magnitude as in the Hillsborough River Basin.

Little Manatee River Basin - The Little Manatee River, from its headwaters to the South Fork Little Manatee, drains an agricultural area. During the rainy season, heavy runoff from this land results in high concentrations of phosphorous, organic nitrogen and nitrogen. During periods of high river flow, ground water is thought to contribute significantly to the flow due to above average fluoride concentrations, color dilution, and increases in solids, BOD, pH and conductivity in the river (TBRPC, 1977c).

Overall, based on data collected by the Hillsborough County Environmental Protection Commission through part of 1976, water quality values for most parameters were generally acceptable, considering the land uses and natural water quality for this part of Florida (TBRPC, 1977c).

Palm River/Sixmile Creek - As was stated in the previous section "Quantity", much of the Palm River and Sixmile Creek has been channelized as part of the Tampa Bypass Canal. The following discussion is based on water quality samples obtained during 1978 and will be discussed as the Tampa Bypass Canal (Shaw, A.J. and Wilkins, R.G., 1979).

Generally, water quality in the Tampa Bypass Canal is poor. Many complaints have been voiced by residents of the area about algae blooms and fishkills. The poor water quality is attributed to industrial and domestic waste discharges, landfill leachate, stormwater runoff and the channelization of the Palm River and Sixmile Creek (Shaw, A.J. and Wilkins, R.G., 1979).

TABLE I.6-8

WATER QUALITY CHARACTERISTICS OF ALAFIA RIVER TRIBUTARIES

STREAM	TRIBUTARY TO	WATER QUALITY CHARACTERISTICS	COMMENTS
Bell Creek	Alafia River	High nitrates	High nitrates attributed to spraying water hyacinths in upstream reservoir.
Fishhawk Creek	Fishhawk Creek	Low BOD Low TOC Moderate dissolved oxygen Moderate bacteria indicators	
Little Fishhawk Creek	Little Fishhawk Creek		Assumed similar to Fishhawk Creek
Turkey Creek	Turkey Creek	High Kjeldahl nitrogen High BOD High phosphate High TOC Low dissolved oxygen	Attributed to discharge from Lykes Brothers Packing Plant in Plant City, seepage from abandoned phosphate mines, agricultural runoff and/or septic systems.
South Prong Alafia River	South Prong Alafia River	High fluoride Moderate dissolved oxygen High TOC Moderate BOD Low nitrogen	Attributed to phosphate mining and processing plants in Polk County. TOC attributed to natural swamp drainage.
North Prong Alafia River	North Prong Alafia River	High nitrates High phosphate High fluoride High ammonia	High nitrates associated with discharge of fertilizer chemical plants and phosphate mining and processing plants in Polk County.

Source: TBRPC, 1977c
Shaw, A.J. and Wilkins, R.G., 1978

During 1978, the Tampa Bypass Canal was characterized by high chlorophyll-a, averaging approximately 30 mg/1; high BOD and low DO, averaging approximately 4.6 mg/1 and 1.8 mg/1, respectively; low nutrients, 0.033 mg/1 (nitrate); and low TOC, averaging 9.64 mg/1. The low nutrients and TOC values appear anomalous. The low nutrient values were attributed to high nitrogen uptake by algae because the Tampa Bypass Canal was "notorious for algae blooms". The low TOC is attributed to the lack of tannic acid water from swamps and floodplains due to channelization. According to Shaw and Wilkins (1979):

> "...., a very high percentage of the Tampa Bypass Canal's TOC average represents BOD; whereas in most other tributaries a large percentage of the TOC is from tannic acid water which does not exert an oxygen demand" (Shaw, A.J. and Wilkins, R.G., 1979).

Wasteload allocation studies show that the maximum allowable Ultimate Oxygen Demand (UOD) load for McKay Bay is greatly exceeded by the nonpoint source wasteload, due primarily to discharges from the Palm River.

Bullfrog Creek Basin - The water quality of Bullfrog Creek is relatively good: low BOD (1.5 mg/l) (yearly averages for 1977); moderate DO (7.9 mg/l); moderate nutrients (0.07 mg/l nitrogen as ammonia, 0.19 nitrogen as nitrate, 0.14 Kjeldahl nitrogen); and moderate bacteria indicators (1254/100 ml fecal coliforms, 3662 total coliforms) (Shaw, A.J. and Wilkins, R.G., 1979).

However, the "Updated Water Quality Assessment" based on monitoring performed in 1976, prepared for the Tampa Bay Regional Planning Council reported that for Bullfrog Creek:

> "HCEPC has received complaints of sludge buildup on selected locations, apparently from fishpond drainage. When dislodged by higher volume flows, these materials could be a significant source of downstream BOD loading. More likely, they represent a chronic condition leading to general problems farther downstream".

> "Coliform counts were high for a watershed of this size and land use and the fecal coliform/FS ratio suggests the possibility of septic tanks or other private system failure during periods of greatest soil saturation" (TBRPC, 1977c).

However, both average total coliform and fecal coliform counts decreased in 1977 from 1976 levels.

Delaney Creek Basin - The water quality of Delaney Creek is seriously degraded due largely to point source discharges. As stated in the "Updated Water Quality Assessment" prepared for the Tampa Bay Regional Planning Council for monitoring performed in 1976:

> "Levels of 16 mg/l for nitrate, 1 mg/l for nitrite, 14 mg/l for ammonia, and 40 mg/l for Kjeldahl nitrogen are astonishing for natural waters and are more typical of untreated wastewaters".
>
> "....Extremely high total coliforms (230,000/100 ml), fecal coliforms (25,000/100 ml), and fecal streptococci (25,000/100 ml) suggest point sources of untreated sewage effluents or improperly operating treatment units are discharging to the creek" (TBRPC, 1977c).

Delaney Creek also suffers from low dissolved oxygen (4.5 mg/l) and high BOD (4.3 mg/l) (Shaw, A.J. and Wilkins, R.G., 1979). This condition is attributed to pastureland runoff and channelization.

Lakes - Lake Thonotosassa is eutrophic and is not expected to improve significantly because of continuing high inputs of nutrients, particularly nitrogen. Monitoring of the water entering and existing in the lake shows that nitrogen as nitrate is being assimilated by and incorporated into biomass (TBRPC, 1977a). Dissolved oxygen ranges from 7 to 12 mg/l during the day and is often supersaturated. The elevated oxygen levels are due to high plant production and probably drop sharply after sundown (TBRPC, 1977a).

Reportedly, fourteen years of citrus pulp has settled in the lake creating a muck bottom that exacerbates the hypolimnetic oxygen depletion which occurs during summertime stratification and serves as a reservoir of excess nutrients. Low levels of dissolved oxygen have not been limited to the summer, however, as evidenced by fishkills being reported in January, 1969, (the largest in the United States that year) and in February, March and May, 1971 (TBRPC, 1977a).

A report issued by the Tampa Bay Regional Planning Council (TBRPC, 1977a) summarizes the lake's problems:

> "The high oxygen demand of these waters when displaced from the lake environment represents a severe drain on the already marginal oxygen resources of the Hillsborough River".
>
> "More important than water quality itself has been its effect on the lacustrine biota. Degradation of the fish and benthic macroinvertebrate fauna are reported; exotic fish flourish in the lake. Native macrophytes have been displaced; blue-green algae dominate the planktonic flora. The lake is currently highly eutrophic and with continuing high inputs of nutrients, particularly nitrogen, conditions are not expected to greatly improve even with the improved point source controls".

Water quality characteristics of Tampa Reservoir also indicate highly eutrophic conditions. Chlorophyll levels are high, ranging up to 160 milligrams per cubic meter. Daytime dissolved oxygen values fluctuate widely, ranging from 3 to 14 mg/l. Phosphate concentrations are high, averaging about 0.3 mg/l. Nitrate levels are frequently high ranging up to 2 mg/l (Texas Instruments, 1978). Sodium and chloride values are approximately twice as high as values measured at upstream stations. However, chloride, sodium and other organic and inorganic chemical concentrations are well below the maximum acceptable limits set by the EPA for raw waters used for public supply. Color exceeds the recommended level but is removed through the treatment process at the Tampa Waste Treatment Plant (TBRPC, 1977a).

Springs - Cyrstal Springs, which maintains the baseflow in the Hillsborough River during the dry season, generally has characteristics similar to its ground water source. Temperature is nearly constant at 23° to 24° C. Conductivity is relatively low and, as can be expected, organic carbon is undetectable. Dissolved oxygen is generally low (2 to 4 mg/l) which is expected of ground water. However, higher values have been reported and are attributed to plant production in the spring run (TBRPC, 1977a).

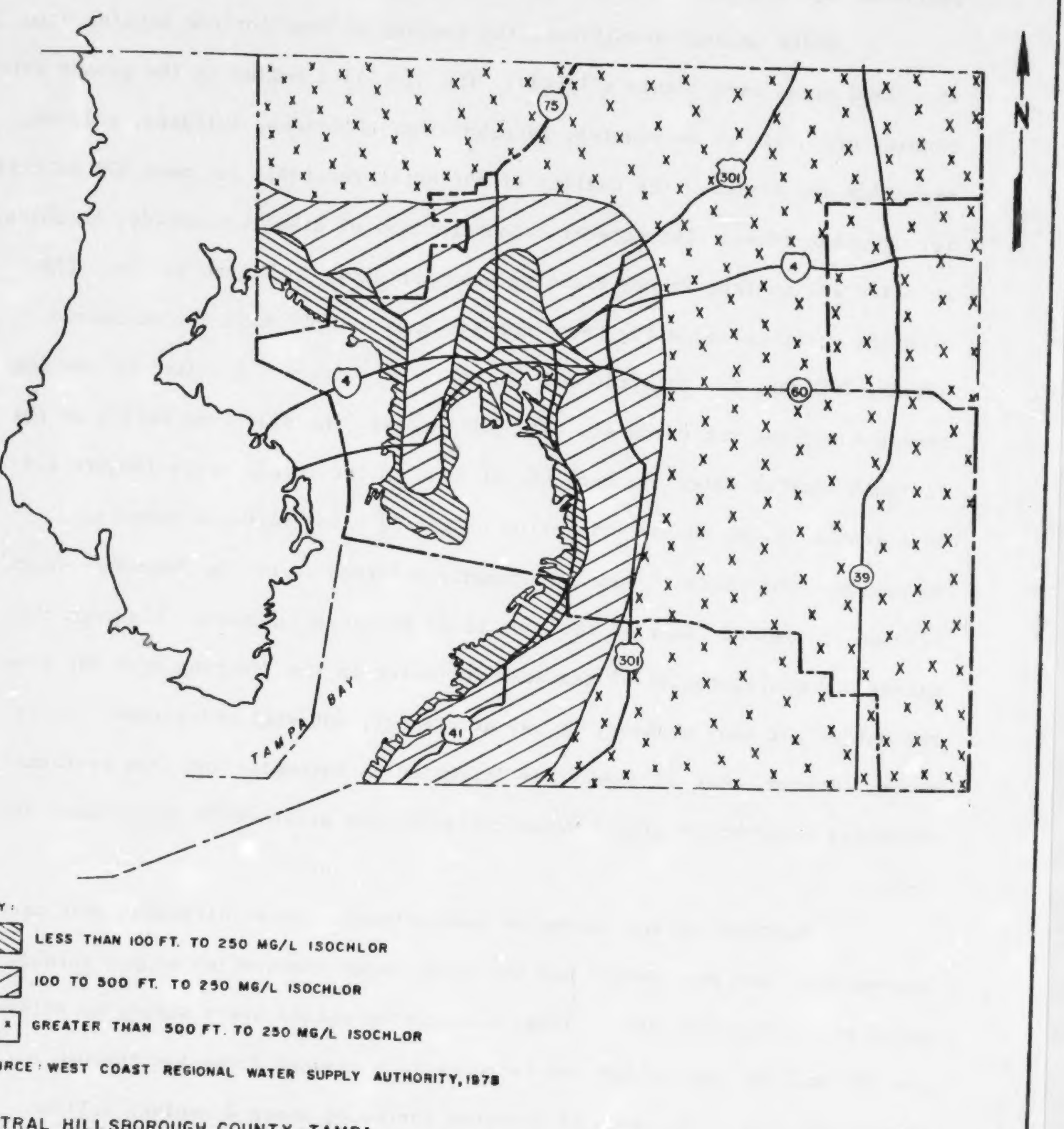
Buckhorn Spring and Lithia Springs, in the Alafia River Basin, are generally low in phosphate ranging from 0.05 to 0.1 mg/l; moderate in fluorides (0.3 to 0.6 mg/l); low in TOC and BOD; and low in nitrogen except for nitrate (N) which ranges from 1.5 to 2.4 mg/l. Dissolved oxygen concentrations are generally above 5.0 mg/l but they vary widely and are often reported to be less than 50 percent saturation (TBRPC, 1977c).

d. Ground Water Quality: Potential impacts of wastewater treatment and disposal on the quality of the water supply in the Planning Area is a key study consideration. It is essential that the ground water system be understood in order to assess the positive or negative effects which may result from the various treatment and disposal methodologies. The following section describes the ground water quality of the Planning Area relative to impact assessment. The quality of ground water, its dissolved inorganic and organic constituents, is a function of natural and other conditions. Dissolved substances are derived from the air, soil and rocks, as well as surface water bodies. The natural chemical characteristics of ground water are related to many factors, such as: (1) the chemical composition of the aquifer and surface drainage; (2) the length of time that the aquifer framework and water are in contact; (3) the permeability of the aquifer; (4) the hydraulic connection between different aquifers; (5) the hydraulic gradient; (6) the rate and amount of recharge; and (7) the rate and amount of discharge. These factors vary from one aquifer to another and from place to place within an aquifer. Thus water quality varies.

In general, concentrations of dissolved solids are lowest near points of recharge, increasing in the direction of ground water flow. A general relationship also exists between water quality and depth in which dissolved solids tend to increase with depth (Shattles, 1965). Figure I.6-18 indicates the relationship between the Planning Area's geography and depth to potable water. The typical natural quality of waters in the surficial aquifer varies slightly from one place to another within the Planning Area. Away from the coastline, the water table aquifer is generally potable, slightly acidic, can be rich in organic material, but is low in dissolved solids. A hardpan of iron oxide stained sands is found in some areas of the county which cause the surficial aquifer waters in contact with the hardpan to be higher in iron concentration than waters above or below the hardpan.

Near the southeastern portion of the Planning Area, the quality of surficial aquifer waters has been studied in detail at a few sites. These studies report that waters from the surficial aquifer are typically low in total dissolved solids (less than 100 mg/l); pH ranges from 4.2 to 6.4; iron from 0.31 to 0.74 mg/l; sulfate from 2 to 3 mg/l; chloride is less than 10 mg/l; and hardness as $CaCO_3$ varies from 12 to 70 mg/l (Swift Agricultural Chemical Corporation, 1978).

In portions of Hillsborough County, relatively low concentrations of radium have been reported. These concentrations are well below the EPA standards of 5 picocuries per liter (Texas Instruments, 1978).



KEY:

▨ LESS THAN 100 FT. TO 250 MG/L ISOCHLOR

▨ 100 TO 500 FT. TO 250 MG/L ISOCHLOR

x x GREATER THAN 500 FT. TO 250 MG/L ISOCHLOR

SOURCE: WEST COAST REGIONAL WATER SUPPLY AUTHORITY, 1978

CENTRAL HILLSBOROUGH COUNTY - TAMPA
201 FACILITY PLAN
ENVIRONMENTAL REPORT
EPA No. C120634010

AVERAGE DEPTH TO SALT WATER INTERFACE

DAMES & MOORE

FIGURE I.6-18

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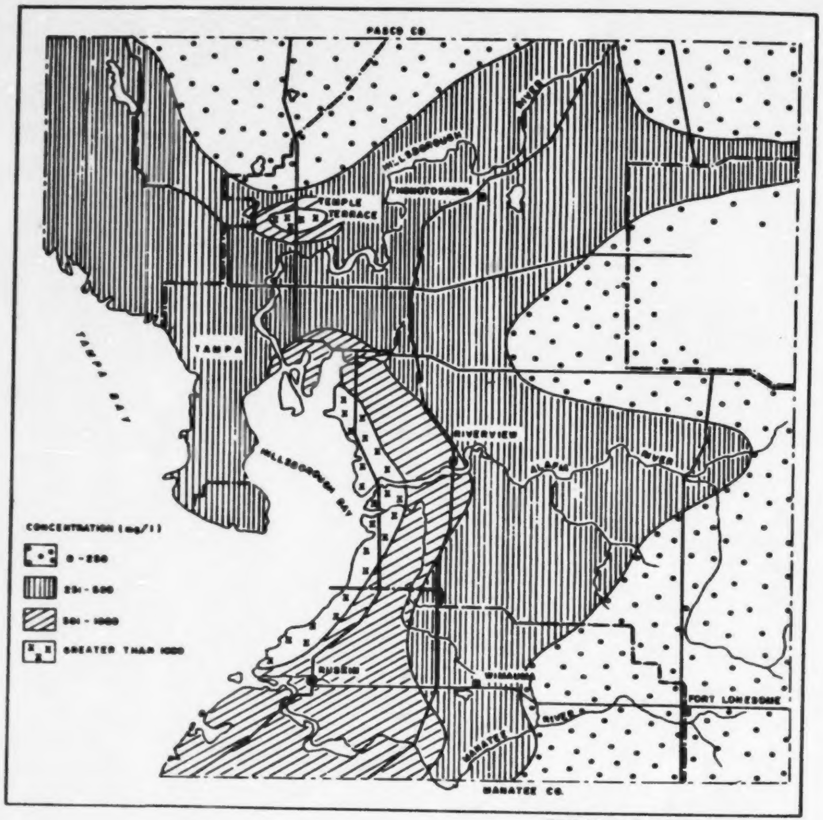
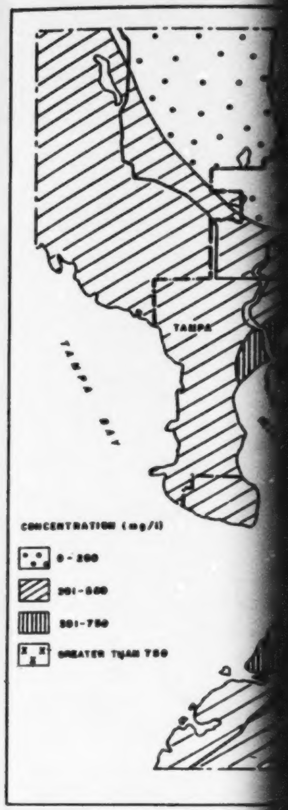
In the coastal portions of the Planning Area, water quality in the surficial aquifer can be similar to seawater or brackish water.

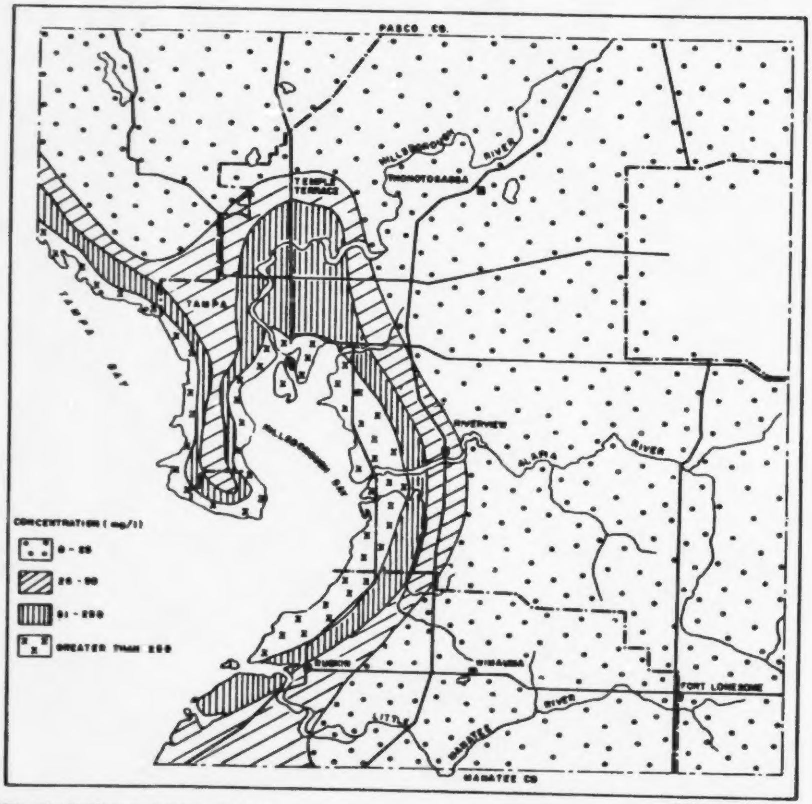
Under natural conditions, the quality of the Floridan Aquifer water in inland areas varies only slightly. The dissolved solids in the ground water consist primarily of carbonates, bicarbonates, chlorides, sulfates, calcium, magnesium and silica. The quality of the water generally can meet EPA criteria for drinking water. The general concentrations of dissolved solids, hardness, chloride and sulfate in the Planning Area are shown in Figure I.6-19. EPA drinking water criteria for these constituents are 500 mg/l for dissolved solids, 250 mg/l for chloride and 250 mg/l for sulfate. A criterion has not been established for hardness. Along the coast, the dissolved solids in the Floridan Aquifer water are much higher than in the inland areas (Figure I.6-19) as a result of the seaward direction of ground water flow and seawater intrusion. The intruded zone is commonly referred to as the "seawater wedge" because the inland limit of the zone tends to slope landward. Although the extent and configuration of seawater intrusion in the Planning Area has been the subject of many studies, it is, at present, not well understood. It is known, however, that in some areas intrusion is extensive and that problems and potential problems of ground water contamination exist (USGS unpublished data, 1979).

Eastward of the intrusion zone a transition or diffusion zone occurs between the "seawater wedge" and the fresh water zones which supply potable water to the Planning Area. Thus, a condition exists where dissolved solids are 500 mg/l or less inland and increase in a seaward direction through a transition zone to the zone of seawater intrusion where dissolved solids concentrations in the ground water approach that of seawater. The boundaries

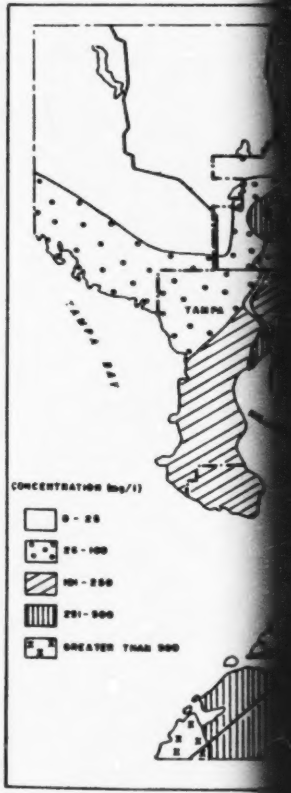

PASCO CO
HILLSBOROUGH RIVER
THONOTOSASSA
TEMPLE TERRACE
TAMPA
TAMPA BAY
HILLSBOROUGH BAY
RIVERVIEW
ALAFIA RIVER
RUSKIN
WIMAUMA
FORT LONESOME
MANATEE R.
MANATEE CO.
CONCENTRATION (mg/l)
0 - 250
251 - 500
501 - 1000
GREATER THAN 1000

DISSOLVED SOLIDS


TAMPA
TAMPA BAY
CONCENTRATION (mg/l)
0 - 250
251 - 500
501 - 750
GREATER THAN 750


PASCO CO.
HILLSBOROUGH RIVER
THONOTOSASSA
TEMPLE TERRACE
TAMPA
TAMPA BAY
HILLSBOROUGH BAY
RIVERVIEW
ALAFIA RIVER
RUSKIN
WIMAUMA
FORT LONESOME
LITTLE MANATEE RIVER
MANATEE CO
CONCENTRATION (mg/l)
0 - 25
26 - 50
51 - 250
GREATER THAN 250

CHLORIDE


TAMPA
TAMPA BAY
CONCENTRATION (mg/l)
0 - 25
26 - 100
101 - 250
251 - 500
GREATER THAN 500

CENTRAL HILLSBOROUGH COUNTY-TAMPA
201 FACILITY PLAN
ENVIRONMENTAL REPORT
EPA No. C1206 34010

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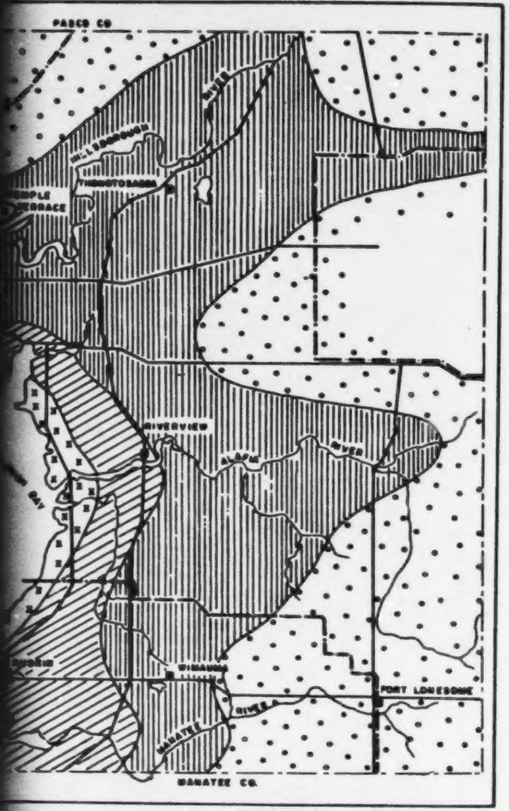
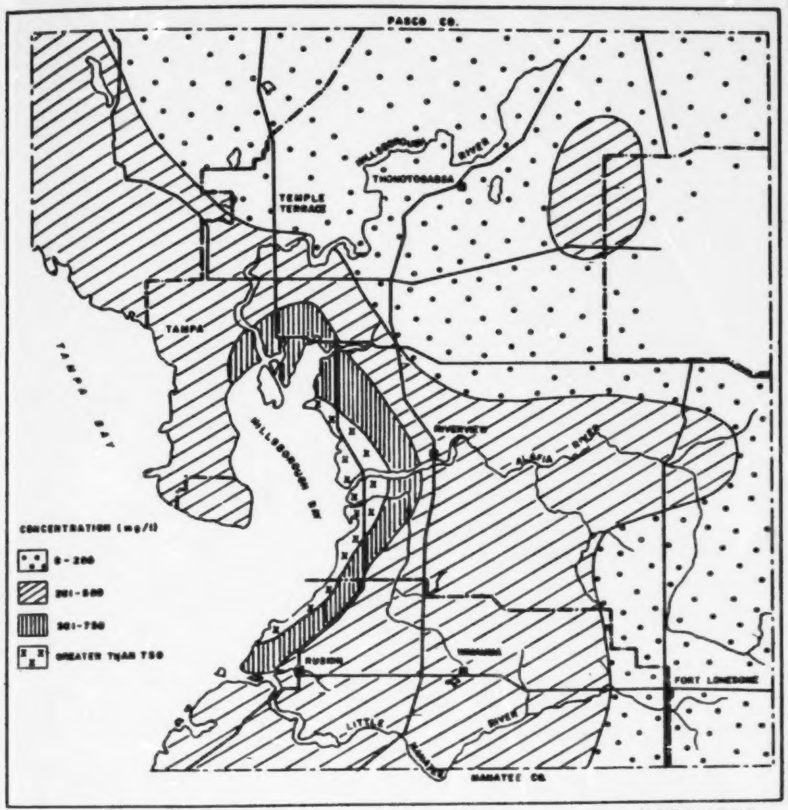
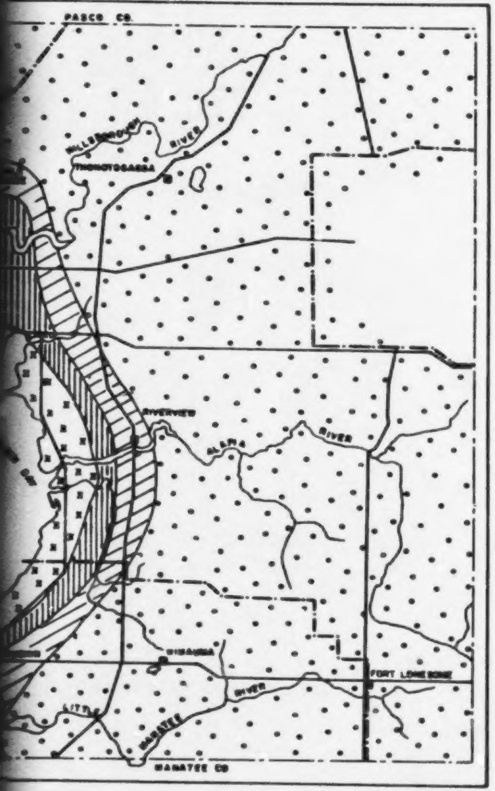

PASCO CO.
HILLSBOROUGH
RIVER
THONOTOSASSA
TEMPLE TERRACE
RIVERVIEW
ALAFIA
RIVER
RUSKIN
WIMAUMA
FORT LONESOME
MANATEE
RIVER
MANATEE CO.

DISSOLVED SOLIDS


PASCO CO.
HILLSBOROUGH
RIVER
THONOTOSASSA
TEMPLE TERRACE
TAMPA
TAMPA BAY
HILLSBOROUGH BAY
RIVERVIEW
ALAFIA
RIVER
CONCENTRATION (mg/l)
0 - 200
201 - 500
501 - 750
GREATER THAN 750
RUSKIN
WIMAUMA
FORT LONESOME
LITTLE
MANATEE
RIVER
MANATEE CO.

HARDNESS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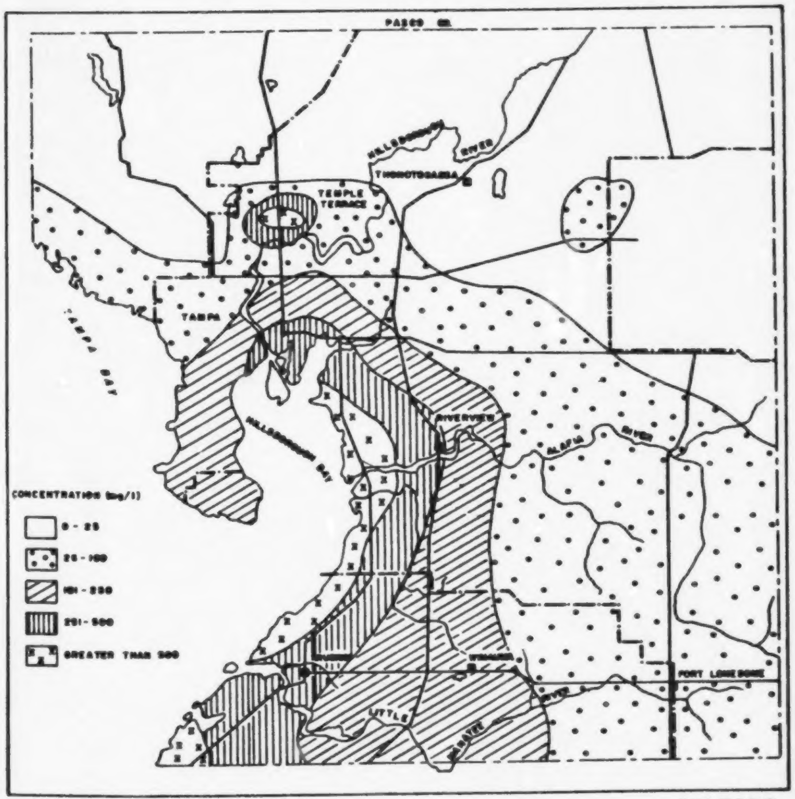
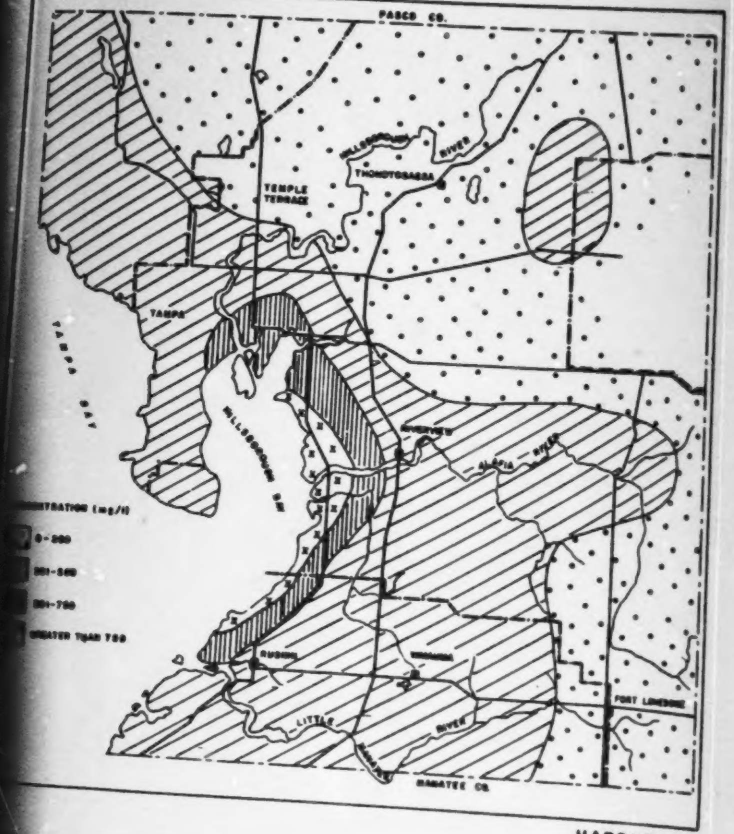
HILLSBOROUGH
RIVER
THONOTOSASSA
RIVERVIEW
ALAFIA
RIVER
WIMAUMA
FORT LONESOME
LITTLE
MANATEE
RIVER
MANATEE CO.

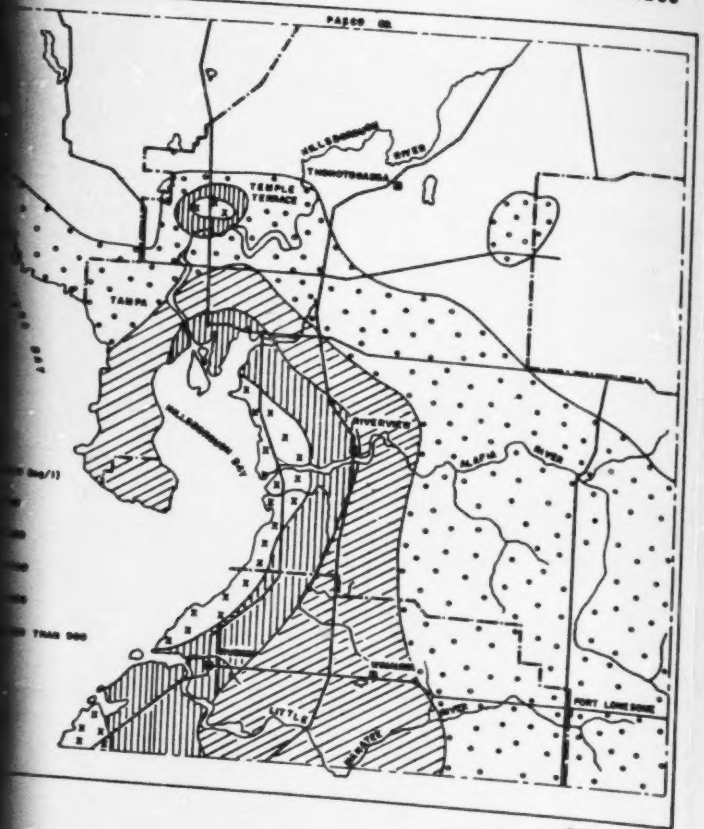
CHLORIDE


PASCO CO.
HILLSBOROUGH
RIVER
THONOTOSASSA
TEMPLE TERRACE
TAMPA
TAMPA BAY
HILLSBOROUGH BAY
RIVERVIEW
ALAFIA
RIVER
CONCENTRATION (mg/l)
0 - 25
26 - 100
101 - 250
251 - 500
GREATER THAN 500
RUSKIN
WIMAUMA
FORT LONESOME
LITTLE
MANATEE
RIVER

SULFATE


PASCO CO.
HILLSBOROUGH RIVER
THONOTOSASSA
TEMPLE TERRACE
TAMPA
TAMPA BAY
HILLSBOROUGH BAY
RIVERVIEW
ALAFIA RIVER
RUSKIN
WIMAUMA
FORT LONESOME
LITTLE MANATEE RIVER
MANATEE CO.
TRATION (mg/l)
0-200
201-500
501-750
GREATER THAN 750

HARDNESS


PASCO CO.
HILLSBOROUGH RIVER
THONOTOSASSA
TEMPLE TERRACE
TAMPA
BAY
HILLSBOROUGH BAY
RIVERVIEW
ALAFIA RIVER
WIMAUMA
FORT LONESOME
LITTLE MANATEE RIVER
(mg/l)
THAN 300

SULFATE

SOURCES:

SHATTLES, P.E., 1965 ; DUERR, A.D., 1975 ; U.S. GEOLOGICAL SURVEY, 1977;
WEST COAST REGIONAL WATER SUPPLY AUTHORITY, 1978

0
4
8
12
MILES

GENERALIZED WATER QUALITY
FLORIDAN AQUIFER
HILLSBOROUGH COUNTY, FLORIDA

DAMES & MOORE

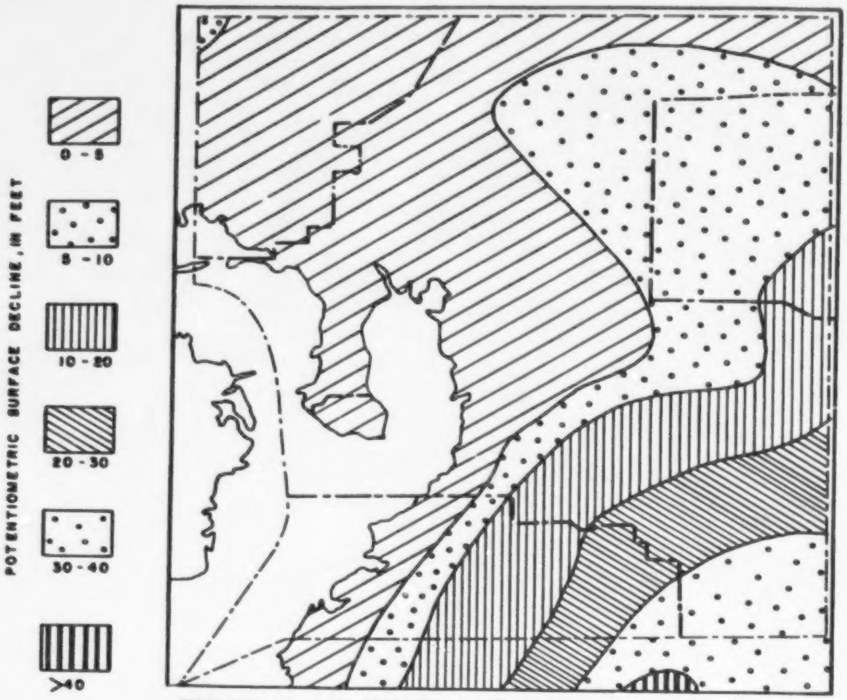
FIGURE I.6-19

or interfaces between these zones tend to slope landward, being closer to the coast at shallower depths and further inland at greater depths.

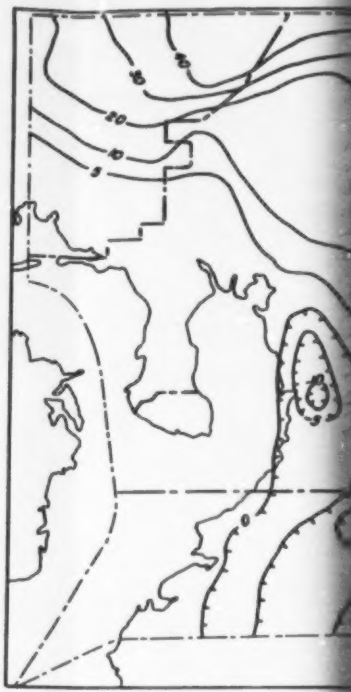
Water quality zonation also occurs with depth. Highly mineralized ground water occurs at depth, throughout the area, coincident with the previously described evaporite zone (Figure I.6-5). The above description of water quality zonation in the Floridan Aquifer is a simplification of relatively complex phenomena which are influenced by many factors. A major influence is the pressure gradient, or difference in the height of the potentiometric surface, between the coastal and inland areas. This gradient influences the subsurface position or location of the water quality zone interfaces. In turn, the pressure gradient is influenced by recharge to and discharge from the aquifer. In turn, aquifer recharge is directly related to regional rainfall. Seasonal and other cyclic variations in rainfall, therefore, will cause the position of the water quality zones to move. In addition, pumping from the aquifer is a major cause of fluctuation and decline of the potentiometric surface. Figure I.6-20 shows seasonal and long-term changes of the potentiometric surface in the Planning Area.

Contamination of the Floridan Aquifer waters may also occur through mechanisms other than seawater intrusion. There are two significant sources of contamination in inland areas. These are contaminated surface waters and contaminated ground waters (from overlying aquifers) which may enter the Floridan Aquifer in the recharge areas.

Surface waters which may become contaminated can enter the aquifer where permeable limestone occurs at or near the surface or through sinkholes and defective wells. An example of pollution through a sinkhole is evident northwest of Tampa as described in the Advanced Report by Greeley and Hansen


POTENTIOMETRIC SURFACE DECLINE, IN FEET
0 - 5
5 - 10
10 - 20
20 - 30
30 - 40
>40

DECLINE IN POTENTIOMETRIC SURFACE
MAY 1969 TO MAY 1975, IN FEET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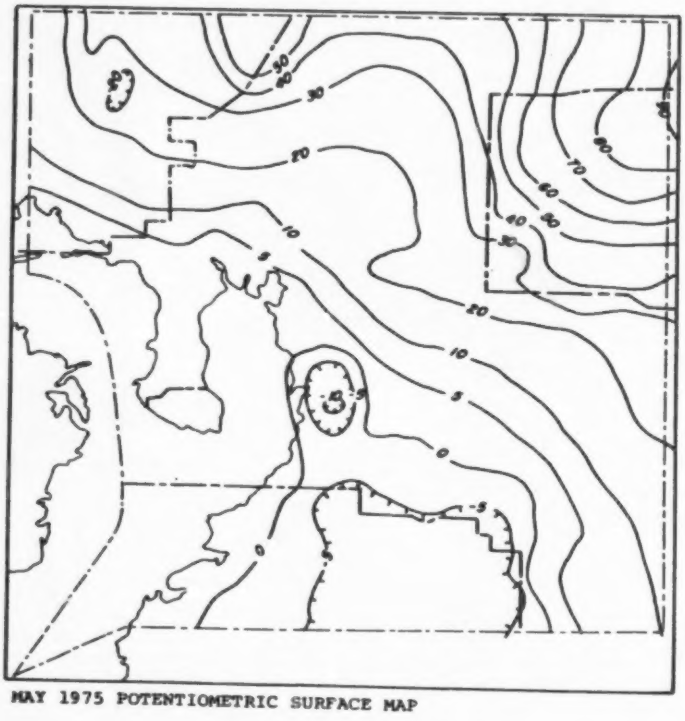
MAY 1977 POTENTIOMETRIC SURF


40
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-5
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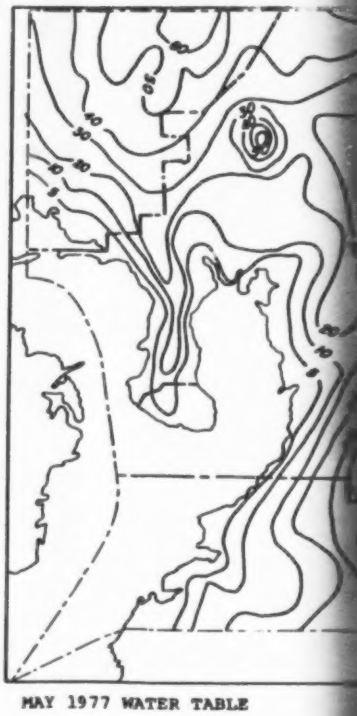
MAY 1975 POTENTIOMETRIC SURFACE MAP


30
40
30
20
10
5
50
20
10
5

MAY 1977 WATER TABLE

— 5 — CONTOUR SHOWS ELEVATION IN FEET OF WATER TABLE OR POTENTIOMETRIC SURFACE (DATUM : MEAN SEA LEVEL)

0

SOURCE : MILLS,L.R.;DUERR,A.D. AND BUONO,A.,1975-MILLS,L.R. AND LAUGHLIN,C.P.,1976-RYDER,P.D.;LAUGHLIN,C.P. AND MILL
RYDER,P.D. AND MILLS,L.R.,1977- RYDER,P.D.; LAUGHLIN,C.P. AND MILLS,L.R.,1978

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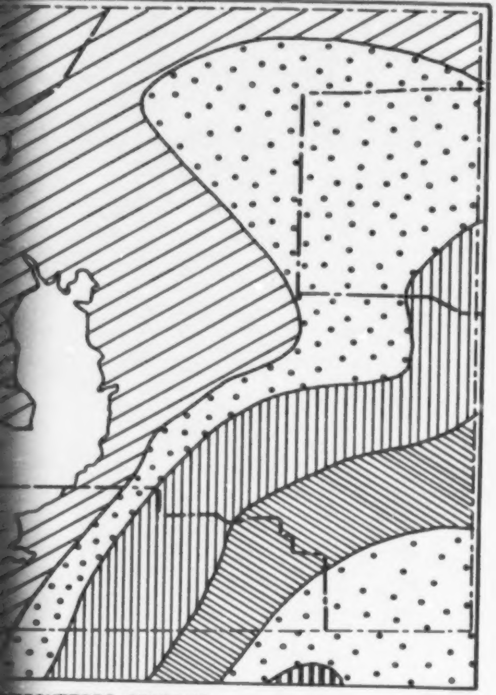
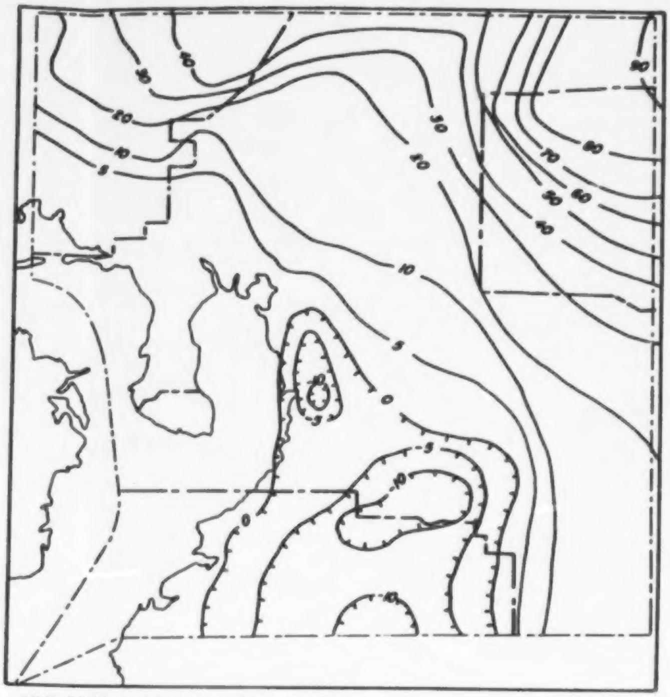


TIOMETRIC SURFACE
1975, IN FEET


30
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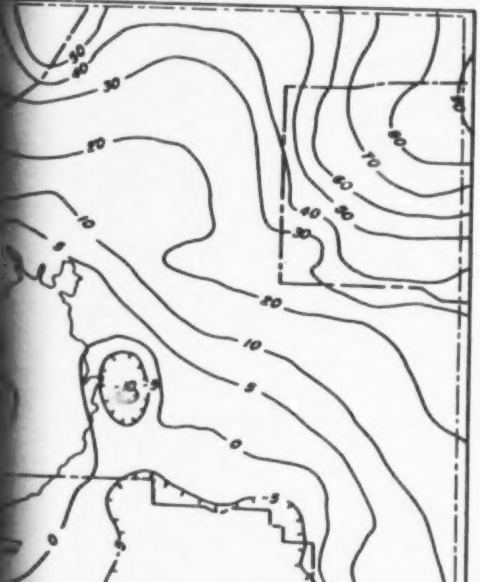
90
30
20
70
80
60
50
40
10
5
0
-5
-10
-5
0
-10

MAY 1977 POTENTIOMETRIC SURFACE MAP

SEPT


50
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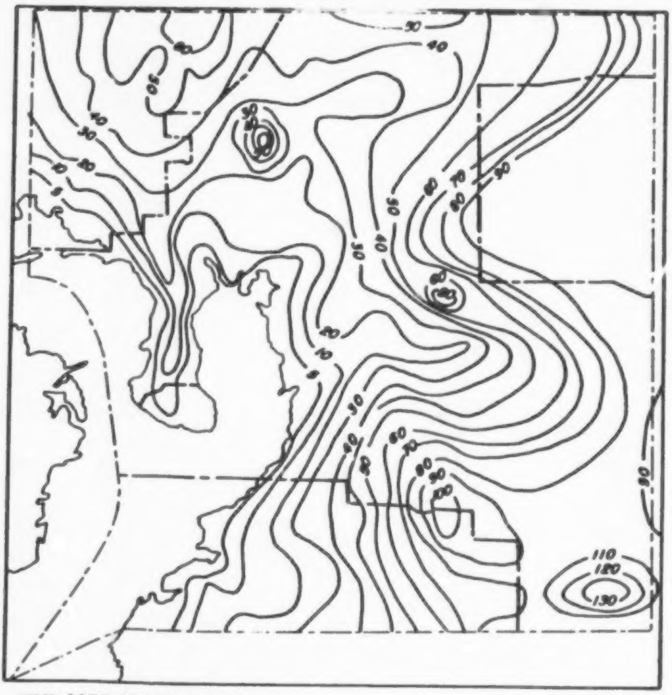
ETRIC SURFACE MAP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130
90

MAY 1977 WATER TABLE

SEPT

N FEET OF WATER TABLE OR
TUM : MEAN SEA LEVEL)

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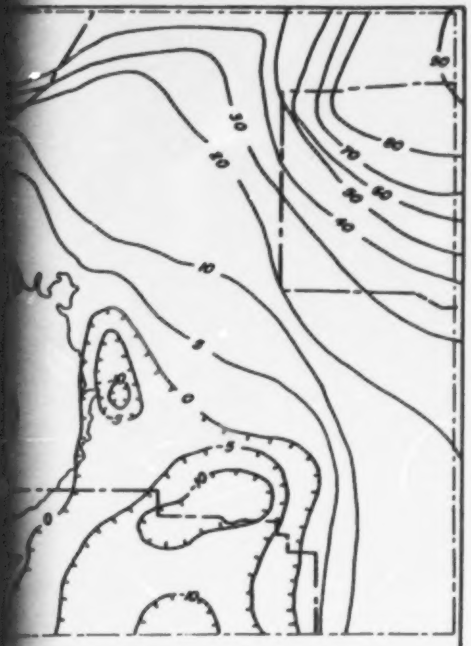
MILES

BUONO,A.,1975-MILLS,L.R. AND LAUGHLIN,C.P.,1976-RYDER,P.D.;LAUGHLIN,C.P. AND MILLS,L.R.,1977-
,1977- RYDER,P.D.; LAUGHLIN,C.P. AND MILLS,L.R.,1978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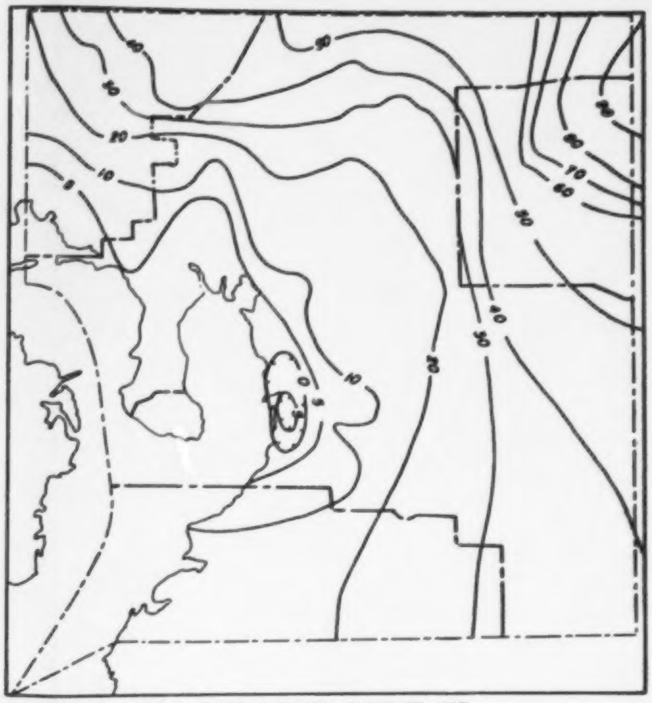
ETRIC SURFACE MAP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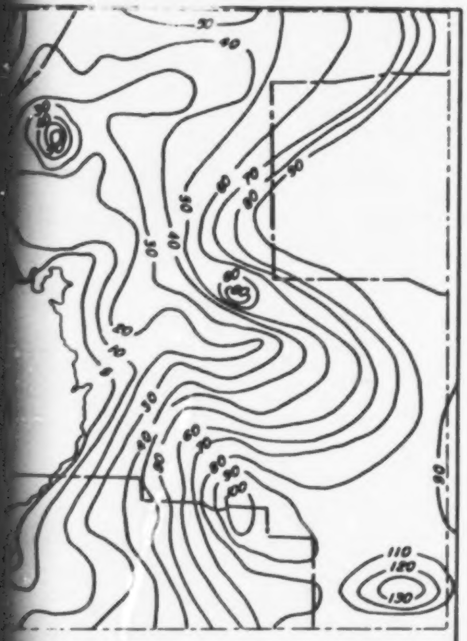
SEPTEMBER 1977 POTENTIOMETRIC SURFACE MAP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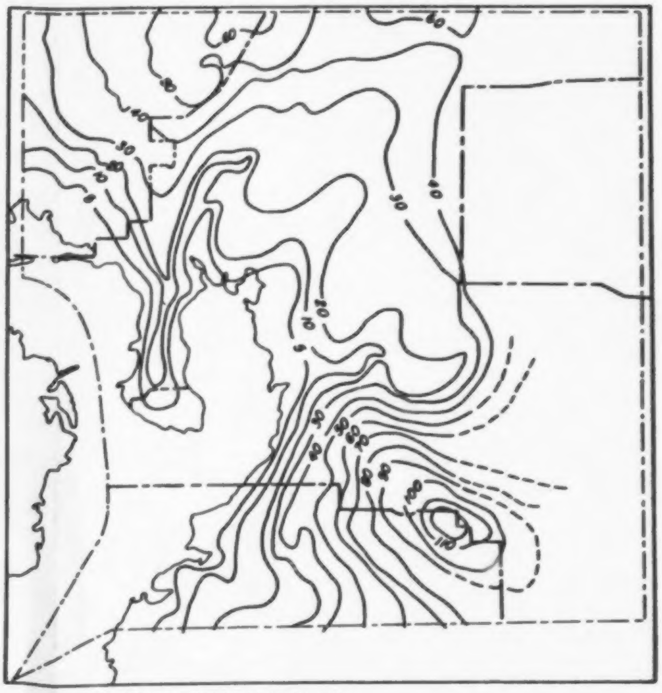
5
100
110
120
130

LE


60
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30
20
10
5
80
90
100
110

SEPTEMBER 1977 WATER TABLE MAP

. AND MILLS,L.R.,1977-

POTENTIOMETRIC SURFACE AND WATER TABLE ELEVATION OF THE HILLSBOROUGH COUNTY AREA

DAMES & MOORE

FIGURE I.6-20

(1979). Here, the Lakewood Estates wastewater treatment plant discharges effluent into a water filled sinkhole which in turn discharges into Curiosity Creek. Downstream, the waters enter the ground water system in the Blue Sink area. Effluent has been detected over two miles away at Sulphur Springs, a source of water for the City of Tampa reservoir.

Contamination of the water table aquifer can occur in several ways. Agricultural sources include the application of fertilizers, pesticides and insecticides on cropland, as well as animal waste products which percolate with surface water through the soil and into the ground water system. Local contamination can also occur through downward seepage from wastewater lagoons, septic systems, landfills and polluted surface waters. These contaminated ground waters may, in turn, enter the Floridan aquifer.

In areas where water moves rapidly through the soils, the aquifer is shallow or confining materials are without sufficient natural filtering or ion exchange (for example, sinkholes or well developed solution features, excessively permeable soils, absent confining beds) contamination may become a serious problem. In the Planning Area, places where potential problems exist include the Temple Terrace area where water quality degradation has been reported (J.W. Stewart, et al., 1978) and the Brandon area where similar problems were reported (personal communication, L. Hall and S. Metcalf, 1979).

In summary, the major potable water supply for the Planning area, the Floridan Aquifer, is bounded by seawater intrusion on the west and highly mineralized waters at depth. These boundaries can only be qualitatively defined and are subject to fluctuation due to both natural and man-induced causes. Within the potable water zone, water quality degradation occurs primarily as a result of the activities of man.

Selection of appropriate wastewater treatment and disposal techniques can mitigate these existing and potential problems. Disposal techniques which recycle water can be used to enhance aquifer recharge and offset withdrawals which can improve existing conditions. Factors such as soil characteristics, hydrogeologic conditions, existing water quality and water use must be considered in the selection of treatment and disposal techniques. Disposal away from areas of potable ground water should be considered. Zones of mineralized ground water, such as those areas along the coast, may be useful to dispose of treated wastewater. However, other hydrogeologic conditions, such as permeability and relationship to potable water supplies, must be evaluated in addition to existing water quality.

I.6.2 Freshwater and Estuarine Biology

a. Introduction: The existing freshwater and estuarine environments of the Planning Area include the following ecosystems:

1. Freshwater - lakes, ponds and streams.
2. Estuarine - Regions along the marine/freshwater interface near mouth of rivers and the Hillsborough Bay, McKay Bay, Old Tampa Bay and Upper Tampa Bay ecosystems.

Biological data are generally available only for major aquatic ecosystems in the Planning Area. Those ecosystems included in this baseline review are listed in Table I.6-9. The biological data available for many of these ecosystems are not always recent and some of the areas referenced may have been dramatically altered by societal development or industrial and domestic pollution since the referenced system was last investigated.

TABLE I.6-9

AQUATIC AND ESTUARINE ECOSYSTEMS INCLUDED IN BASELINE REVIEW FOR BIOLOGICAL ASSESSMENT

Fresh Water

Lotic Systems

- Hillsborough River/Reservoir
- Tampa Bypass
- Alafia River
- Little Manatee River (Headwaters)
- Itchepackesassa Creek
- Blackwater Creek
- Holloman's Branch
- Trout Creek
- Cypress Creek
- Cowhouse Creek

Lentic Systems

- Lake Thonotosassa
- Ponds On University of South Florida Campus
- Pond at Morris Bridge Road (T28S, R20E, S6)

Estuaries

- Hillsborough Bay
- McKay Bay
- Upper Tampa Bay
- Old Tampa Bay

b. Description of Freshwater Study Areas: The major drainage basins within the region are those of the Hillsborough, Tampa Bypass and Alafia Rivers, and their tributaries. In addition, many lakes and springs are found over substantial areas of the land surface.

Flowing surface waters, such as rivers and creeks, comprise the lotic ecosystem. Most of these systems in the Planning Area are characterized by:

1. Shallow headwaters, typically with intermittent deep pools and shallow riffle areas, gradually developing into deeper, slow moving waters as they proceed towards other streams or the Tampa Bay Estuary,

2. Relatively clear, deeply stained water, especially near headwaters,

3. Substrate consisting largely of scattered limestone boulders, cobbles or gravel in faster flowing streams, becoming sand, silt, mud and organic debris along slower moving stretches, and

4. Relatively high concentrations of nutrients, both from natural and from industrial sources.

Non-flowing surface waters, such as ponds and lakes, comprise the lentic ecosystem. By definition, ponds are small lakes shallow enough to support rooted vegetation over most of the area of the water body. Lakes, on the other hand, usually are sufficiently deep that growth of rooted vegetation is limited to areas along the periphery of the water body.

Most of the 234 lakes or ponds within the region are landlocked and without surface flow into or out of them. A number of these were excavated by the phosphate-mining industry or were formed by sinkholes. Many of these lentic habitats are either intermittent lakes or are too deep to support significant biota. Conversely, others are managed lakes and support important recreational fisheries.

c. Description of Estuarine Study Areas: The region where tidal action influences the physical characteristics of a freshwater ecosystem is defined as an estuary. The resulting zone of interaction has considerable variation in both physical and biological parameters, but generally this region is characterized by:

1. A salinity that varies between 3-5 parts per thousand (PPT) and 25-30 PPT,

2. High energy input from marine and freshwater organic matter brought in from the respective ecosystems and from insulation or solar radiation,

3. Low species diversity, resulting in fragile, relatively simple food webs and often very high densities,

4. Highly organic substrates, with a nearly anaerobic region beneath the surface sediment.

The estuaries of the Planning Area include Old Tampa Bay, Hillsborough Bay, McKay Bay, portions of Tampa Bay and those portions of the freshwater streams under tidal influence from these bays. Most of these streams enter the eastern bay areas of Hillsborough and Tampa Bays. However, the variation in salinities characteristic of an estuarine environment is also typical of the Old Tampa Bay area.

d. Biology of Freshwater and Estuarine Ecosystems Investigated: The distribution of species associated with aquatic habitats is generally influenced both spatially and temporally by specific physical factors, such as salinity, temperature, tidal stage, flow conditions, substrate type, dissolved oxygen, pH and water depth; as well as biological factors, such as available food, shelter and nursery areas.

In the following discussion, the general role and importance of each group of aquatic organisms is described followed by one or more tables of species characteristic of the ecosystems in the Planning Area. Although the biological findings presented are taken from numerous studies conducted in the Planning Area all of the species lists are not site specific. Thus, for a given stream, lake or for a specific point in the bays, only a portion of these organisms may be represented.

Phytoplankton - Phytoplankton consist of small, photoautotrophic algae of open waters, having limited powers of locomotion and, therefore, more or less dependent upon water currents for their distribution. Their occurrence in a stream or river is often a result of breaking loose from algal communities attached to a substratum or entering a stream from the outflow of a lake, although slow moving rivers may support an actively growing community. They usually have relatively short life spans measured in days (Wetzel, 1975; Odum, 1971).

Temporal and spatial distrubution of these organisms is dependent on several environmental factors. In addition to the basic roles of light and temperature, they require a means of remaining in the euphotic zone for sufficient lengths of time to permit photosynthetic activity to promote growth and reproduction. A number of nutrients are also required, particularly compounds of inorganic nitrogen and phosphorous and often members of the major classes of organic molecules including certain vitamins. Biological limitations may also be imposed on the growth of phytoplankton populations. For example, growth inhibiting secretions may be produced by some species or selective predation or grazing may reduce one or more populations from the community.

The community of phytoplankters provides the major mechanism for energy transfer from sunlight to non-photosynthetic members of the aquatic ecosystem. The position of these algae, therefore, is at the base of the food web. Phytoplankton are consumed by zooplankton and other primary consumers which in turn provide food for large animals. Thus, phytoplankton abundance, in part, determines the quality and quantity of larger organisms which depend upon them for food. Within the physical and biological limitations of the environment these autotrophs may provide the highest gross productivity in the community. Although seasonal fluctuations in density and diversity of algal communities often appear, the number of species generally remains constant from year to year excepting the occurrence of outside perturbations (Wetzel, 1975).

Extensive accumulations of phytoplankton at or near the surface of the water often form visible floating patches described as blooms. Blooms of dinoflagellates are a regular occurrence along the Florida west coast where they may provide red tides.

Red tides in Florida are most often caused by the accumulation of a single species of unarmored, neritic dinoflagellate, Gymnodinium breve. The term red tide is somewhat of a misnomer since outbreaks of G. breve may stain the water brown, yellow, or green as well as red. The occurrence of these red tides is a matter of economic and environmental concern since the causative organism releases a variety of toxic substances (Sasner, 1965) which, in sufficient concentrations, cause mortality of fish, shellfish, birds, turtles and porpoise (Ray and Wilson, 1957; Steidinger, Barklew and Ingle, 1972).

During the period 1844 - 1960, a total of 17 toxic red tides occurred along the Florida west coast (Rounsefell and Nelson, 1966). Seven of these tides (from 1947 - 1960) were definitely caused by *G. breve*. Over 500 million fish were killed in the 1947 outbreak (Rounsefell and Nelson, 1966; Torpey and Ingle, 1966) and the cost of disposal of dead fish from the 1971 outbreak averaged $10,000 per day. A subsequent red tide bloom occurred in 1974, although it was not as severe as the one in 1971 (Shaw and Wilkins, 1977).

Fortunately, the occurrences of red tides do not generally affect commercial fishing or shellfish harvest. Most of the fish killed are inshore "trash" fish and, while the potential exists for damage to shellfishing grounds, the generally low salinities associated with these areas tend to limit the growth of *G breve* and thus prevent the occurrence of red tide near these important habitats.

The physico-biological factors controlling *G. breve* are not well defined. This dinoflagellate is present throughout the year and localized "micro-blooms" are a normal part of the life cycle. For these "microblooms" to reach red tide proportions, however, suitable physical factors must exist. Analyses of field data (Rounsefell and Nelson, 1966) indicates that the temperature optimum for *G. breve* is 26 - 28° C (Finucane, 1960) and the optimum salinity range is 27 - 37 ppt. Examination of a variety of physical and biological factors suggests that micronutrients, rather than macronutrients are probably limiting to *G. breve* populations (Doig, 1972). Significant blooms of *G. breve* are often preceded by periods of high rainfall suggesting that flooded rivers may transport necessary growth substances into estuarine areas for these organisms (Ingle, 1965). These substances are thought to be natural chelaters, increasing the availability of trace metals (Wilson and Guior, 1955).

Wind effects is a physical factor which plays an important role in the formation of G. breve blooms. Although G. breve is destroyed by high winds and wave action, gentle winds serve to enhance the accumulation of G. breve, causing red tides (Steidinger and Ingle, 1972).

Several authors suggest that municipal wastes may cause, or at least increase, the intensity of red tides (Harris, et al., 1972; Wetzer, 1975) but Steidinger and Ingle (1972) have provided evidence that outbreaks of red tides are not associated with disposal of municipal wastes.

Those phytoplankton most commonly occurring as tolerant organisms and considered characteristic of eutrophic conditions are representatives of the Cyanophyta or blue-green algae (Palmer, 1968). The blue-greens most commonly identified as typical of eutrophic conditions are Anabaena, Anacystis, Aphanizomenon and Oscillatoria (Cole, 1975). In addition to forming large, mucous secreting mats, some of the blue-greens release toxins into the water (Odum, 1971; Zawnecki, 1968; Cole, 1975) and very few are of significant nutritional value (Cole, 1975).

Algae, other than blue-greens, that form significant populations in the phytoplankton are the Chlorophyta, or green algae; the Chrysophyta, or golden-brown algae; the Bacillariophyta, or diatoms; and several flagellates, mostly unicellular forms, such as the euglenoids, dinoflagellates and cryptomonads. The most important phytoplankters are usually the diatoms, although many diatoms are sessile and appear as plankton only when broken loose from the periphyton. All diatoms have siliceous cell walls and many form colonies or filaments. The euglenoids are not always planktonic but do occur in very great numbers under proper conditions, particularly in shallow water with high ammonia and/or organic materials in solution (Wetzel, (1975). Many of the dinoflagellates have very specific requirements with narrow tolerances for calcium, pH, dissolved organic nutrients and temperature.

Few, intensive phytoplankton studies have been completed in the freshwater systems in the Planning Area. These studies indicate considerable variation exists, primarily as a result of differences in nutrients and/or salinity among the systems investigated. Diatoms and green algae tend to dominate in freshwater areas; dinoflagellates become more abundant in brackish water, near the mouth of major streams; and diatoms become dominant again in marine areas (Steidinger, 1973). Brackish water areas generally have a lower species diversity than that found in fresh or marine systems.

A list of algae typifying the fresh water ecosystems in the Planning Area is included in Table I.6-10 and common algae found in the estuaries of the Planning Area are listed in Tables I.6-11 and I.6-12.

The most abundant species in Old Tampa Bay are the Rhodophyta (red algae), many of which are attached, and the Chlorophyta (green algae), most of which are free floating (Table I.6-11). The most abundant species observed by Phillips (1960b) were the green algae, *Enteromorpha intestinalis* and *Ulva latuca*, and the red algae, *Hypnea musciformis*, *Gracilaria verrucoas*, *Spyridia filamentosa*. However, *Hypnea musciformis* was never found in the Mobbly Bay Station (upper end of Old Tampa Bay) while *Gracilaria verrucosa* was found year round and at all stations. The number of species of algae decreased from the southern portion of Tampa Bay, northward, possibly as a result of a decrease in salinity. In general, the species abundance was lowest during the summer and number of organisms was generally highest during winter and spring.

TABLE I.6-10

PHYTOPLANKTON TYPICAL OF FRESHWATER ECOSYSTEMS IN THE PLANNING AREA

Chrysophyta (Golden-brown algae)

Licmorpha sp.
Talassionema sp.
Leptocylindrus sp.
Certaulina sp.
Asterionella sp.
Hemiaulus sp.
Rhizosolenia sp.
Nitzschia sp.
Cymbella sp.
Melosira sp.
Navicula sp.
Amphiprora sp.
Eunotia sp.
Synedra sp.
Gyrosigma sp.
Gomphonema sp.
Cocconeis sp.
Chaetoceros sp.
Tetragoniella
Paralia sulcata
Pinnularia sp.
Surirella sp.
Bacillaria paradora
Frustulia sp.
Cyclotella sp.

Chlorophyta (Green algae)

Scenedesmus sp.
Ankistrodesmus sp.
Oocystis sp.
Tetrastrum sp.
Mougeotia sp.
Closterium sp.
Closteriopsis sp.
Actinastrum sp.
Crucigenia sp.
Treubaria sp.
Nitella sp.
Hydrodictyon sp.
Chlamydomonas sp.
Chara sp.
Cosmarium sp.
Pediastrum sp.
Spirogyra sp.

Cyanophyta (Blue-green algae)

Oscillatoria sp.
Anacystis sp.
Lyngbya sp.
Anabaena sp.

Euglenophyta

Euglena sp.
Phacus sp.
Trachelomonas sp.

Pyrrophyta (Dinoflagellates)

Peridinium sp.
Gymnodinium sp.
Ceratium sp.
Gonyaulax sp.
Prorocentrum sp.
Dinophysis sp.

TABLE I.6-11

MARINE ALGAE CHARACTERISTIC OF THE ESTUARIES IN THE PLANNING AREA

Species	Growth Characteristics
Cyanophyta	
Anacystis aeruginosa	1
Calothrix confervicola	1
Calothrix pilosa	1
Lyngbia aestuarii	1
Lyngbia confervoides	1
Lyngbia semiplena	1
Microcoleus chthonoplastes	1
Oscillatoria nigroviriois	1
Oscillatoria subuliformis	1
Microcoleus lyngbiaceus	1,3
Calothrix crustacea	1,3
Chlorophyta	
Chaetomorpha brachygona	2,3
Chaetomorpha linum	2,3
Cladophora glaucescens	1
Cladophora luteola	1
Entermorpha clathrata	1
Enteromorpha flexuosa	1,3
Enteromorpha intestinalis	1
Enteromorpha lingulata	1
Enteromorpha plumosa	1
Enteromorpha proplifera	1,3
Enteromorpha ramulosa	1
Enteromorpha salina	1
Protoderma marinum	1
Rhizoclonium kerneri	1,3
Rhizoclonium kochianum	1
Ulva lactuca	1,3
Ectocarpus elachistaeformis	1
Ectocarpus mitchellae	1
Ectocarpus siliculosus	1
Myriotrichia subcorymbosus	1
Rosenvingea intricata	1
Sargassum filipendula	1,2
Sargassum polyceratium	2
Sphacelaria furcigera	1

TABLE I 6-11 (Continued)

Species	Growth Characteristics
Chlorophyta	
Enteromorpha flexuosa	1,3
Enteromorpha prolifera	1,3
Monostroma oxyspermum	1,3
Ulva lactuca	1,3
Chaetomorpha gracilis	1,3
Chaetomorpha brachygona	1,3
Chaetomorpha linum	1,3
Rhizoclonium kerneri	1,3
Rhizoclonium riparium	1,3
Cladophora repens	1,3
Derbesia vaucheriaeformis	1,3
Boodleopsis pusillia	1,3
Rhodophyta	
Acanthophora muscoides	1,2
Acanthophora spicifera	1,2
Acrochaetium flexuosum	1
Achrochaetium sargassi	1
Acrochaetium seriatum	1
Agardhiella tenera	2
Bostrychia rivularis	1
Centroceras clavulatum	1
Ceramium byssoideum	1
Ceramium deslongchampsii	1
Ceramium rubrum	1
Ceramium subtile	1
Ceramium tenuissimum	1
Champia parvula	1
Dasya pedicellata	2
Erythrotrichia carnea	1
Eucheuma isiforme	2
Celidium corneum	1
Gelidium crinale	1
Gomotrichum alsidii	1
Gracilaria blodgettii	2
Gracilaria damaecornis	2
Gracilaria verrucosa	1,2
Hypnea cervicornis	2
Hypnea cornuta	2
Hypnea musciformis	2
Laurencia poitei	1
Lomentaria baileyana	1,2
Polysiphonia ferulacea	1
Polysiphonia macrocarpa	1
Polysiphonia ramentacea	1
Polysiphonia subtilissima	1

TABLE I.6-11 (Continued)

Species	Growth Characteristics
Rhodophyta	
Rhabdonia ramosissima	2
Spyridia filamentosa	1,2
Catenella repens	1,3
Caloglossa leprieurii	1,3
Murrayella periclados	1,3
Bostrychia radicans	1,3
Bostrychia calliptera	1,3
Bostrychia scorpioides	1,3
Bostrychia binderi	1,3
Xanthophyta	1
Vaucheria sp.	1
Phaeophyta	
Colpomenia sinuosa	Data not available
Dictyopteris delicatula	
Dictyota dentata	
D. Lincaris	
Dilophus alternans	
Giffordia conifera	
Myrionema strangulans	
Sargassum polyceratium	
Spatoglossum schroederi	
Ascocyclus orbicularis	
Bachelotia antillarum	
Ectocarpus dasycarpus	
E. elachistaeformis	
E. siliculosus	
Giffordia rallsiae	
Stilophora rhizodes	
Cladosiphon occidentalis	
Ectocarpus intermedius	
Nemacystus howei	
Sporochnus bolleanus	
S. pedunculatus	
Stictyosiphon subsimplex	
Dictyota cervicornis	
D. dichotoma	
D. divaricata	
Padina vickersiae	
Pocokiella variegata	
Rosenvingea intricata	
R. orientalis	

TABLE I.6-11 (Continued)

Species	Growth Characteristics
Phaeophyta	
Acinetospora crinita	Data not available
Giffordia indica	
G. mitchelliae	
Myriotrichia subcorymbosa	
Sargassum filipendula	
S. fluitans	
S. natans	
S. pteropleuron	
Spachelaria furcigera	
S. tribuloides	

1 - Periphytic
2 - Floating
3 - Occurs as Epiphyte on Mangrove Roots

Source: Phillips, 1960b; Rehm, 1974; Earle, 1969

TABLE I.6-12

PHYTOPLANKTON COLLECTED IN UPPER TAMPA BAY AREA (TECO, 1977)

Species
Actinoptychus senarius
Peridinium quinquecorne
Biddulphia aurita
Biddulphia mobiliensis
Amphora spectabilis
Triceratium favus
Synedra sp.
Mastoglia sp.
Diploneis crabo
Gyrodinium fissum
Podosira stelliger
Hantzschia virgata
Biddulphia dubia
Actinoptychus undulatus
Actinoptychus splendens
Actinocyclus sp.
Peridinium leonis
Rhizosolenta calcar
Coscinodiscus granii
Chaetoceros danicum
Lithodesmium undulatum
Coscinodiscus centralis
Oxytoxum scolopax
Bellerochea malleus
Amphora marina
Ceratium furca
Peridinium depressum
Melosira nummuioides
Chaetoceros simplex
Peridinium oblongum
Pyrophacus steinii
Peridinium pentagonum
Peridinium subinerme
Striatella unipunctata
Streptotheca tamesis
Grammatophora marina
Massartia glauca
Fragilidium sp.
Tropidoneis lepidoptera
Coscinodiscus radiatus
Biddulphia Rhombu
Rhizosolenia stolterfothii
Navicula cancellata
Auliscus sculptus
Scenedesmus quadricauda
Gyrodinium spirale
Biddulphia sinensis
Polykrikos hartmannii
Navicula wawrikae
Amphiprora gigante
Rhizosolenia alata
Rhizosolenia styliformis
Navicula lyra
Skeletonema costatum
Oscillatoria sp.
Hemiaulus sinensis
Rhizosolenia delicatula
Ceratium hircus
Asterionella japonica
Gonyaulax polygrama
Rhizosolenia setigera
Nitzschia delicatissima
Nitzschia pungens
Cerataulina pelagica
Leptocylindrus danicus
Peridinium pellucidum
Nitzschia closterium
Thalassionema nitzschioides
Licmophora
Prorocentrum minimum
Gonyaulax digitalis
Dinophysis caudata
Skeletonema tropicum
Thalassiosira aestivalis
Gonyaulax monilata
Coscinodiscus eccentricus
Gonyaulax diacantha
Peridinium divergens
Ceratium fusus
Dissodium lenticula

TABLE I.6-12 (Continued)

Species
Euglena sp.
Biddulphia alternans
Achnanthes longipes
Prorocentrum micans
Guinardia flaccida
Bacillaria paradoxa
Agmenellum sp.
Polykrikos schwartzi
Corethron criophilum
Anabaena sp.
Thalassiosira decipiens
Peridinium claudicans
Gymnodinium splendens
Coscinodiscus marginatus

In most of Hillsborough Bay and McKay Bay, the common algae occurring are species of Ulva, Gracilaria, and Enteromorpha (Simon, 1975; Lewis and Courser, 1972).

In extensive phytoplankton surveys conducted in Upper Tampa Bay (TECO, 1977), 133 species were collected, comprised primarily of Diatoms (83 species) and Dinoflagellates (42 species) with the remaining species distributed among other taxa. The Diatom, Skeletonema costatum, was the most abundant organism occurring in this study and highest numbers of diatoms occurred during the fall and winter samplings. The most abundant Dinoflagellate obtained was Ceratium hircus, with Dinoflagellate species most common in spring and summer. Oscillatoria, a blue-green alga, was sporadically very abundant, especially during late summer and fall.

Dawes (1967) reported the presence of algal Epiphytes on a green alga, Caulerpa, and on five sea grass species: turtle grass (Thalassia testudinum), wire grass (Dipcanthera wrightii), manatee grass (Syringodium filliforme), widgeon grass (Ruppia maritima) and Halophila englamanni.

In addition, the prop roots of the red mangroves (Rhizophora mangle) in the Planning Area have been shown by Rehm (1974) to contain a variety of epiphytic algae, particularly species of the Ulotrichales and Cladophorales (Table 3.6-11). Most algal species were those capable of being exposed to air during low tides. Their presence is apparently a function of tidal schedule, light penetration through the mangroves and substrate type associated with the mangroves. In Tampa Bay, 7 species of red (Rhodophyta), 12 species of green (Chlorophyta), and 2 species of blue-green algae (Cyanophyta) were collected.

Recent studies by Dawes and others (1979) indicate that the energy available from the epiphytic algae in the algal-seagrass (or Thalassia) community is as great as that available from the seagrass alone. These algal epiphytes, as noted by Ballantine (1979) contribute to primary productivity, supply food for grazers, and often comprise the dominant species present. Some workers (Linskens, 1963; Citharel, 1972; and Hallin, 1973, as referenced in Ballantine, 1979) have suggested a transfer of metabolites between these epiphytic algae and their hosts.

A general correlation has been reported between phytoplankton productivity, as measured by Chlorophyll-a and general nutrient loads in the Tampa Bay area (Marshall, 1956; Odum, 1953). Thus a gradient in Chlorophyll-a concentrations occurs ranging from a high, in 1977, of 20 mg/l or more in McKay and Hillsborough Bays and in Old Tampa Bay above the Courtney Campbell Causeway and the large inlet, to a low of less than 5 mg/l near the mouth of Tampa Bay (Shaw and Wilkins, 1977).

Seagrasses - These macrophytes are characteristic of marine and estuarine habitats and form a significant producer component in the estuaries of the study area. The dominant seagrasses are species of Syringodium, Ruppia, Thalassia, Halodule and Hallophila (Phillips, 1960a,b).

Phillips attributed several important functions to these seagrass meadows, functions associated in large part to the very dense growth characteristic of most species. These functions include: 1) substrate for epiphytic growth; 2) reduction in tidal flushing, allowing increased accumulation of non-attached and attached algae; 3) accumulation of soft, muddy substrates with concomitant development of algae adapted for these substrates, such as Codiaceous species; and 4) general protection from wave action of organisms in these grass beds. The Aufwuchs, or epiphytic, community associated with these seagrasses may comprise one of the more important microhabitat associations present in the estuaries of the study area. This microecosystem is comprised of a bacterial film and numerous periphytic algae, protozoa and rotifers. These organisms are then transported in an energy flow through larger animals, including, eventually, shrimp and fish, and therefore comprise a significant, if not vital, component of the food web in the Tampa Bay area. Obviously, the amount of this important epiphytic association is greatly enhanced by the increased surface area afforded by the numerous, long, narrow leaves of these plants (Moore, 1963). Many of these species are also very important in providing cover and concealment for immature shrimp and fish that occur in the Planning Area and so indirectly affect the maintenance of a stable recreational and commercial fishery in the area (Moore, 1963). These plants also comprise an important link in the food web in the form of the organic detritus and the microbial community that is associated with this detritus (Fenchel, 1970). Figure I.6-21 describes the seagrass meadow distribution for most of the Planning Area as of 1978. In addition, the Tampa Port Authority has begun a study to further map these beds.

The most widely studied of these seagrasses is Thalassia testudinum, or turtle grass, a common macrophyte in many areas of the Tampa Bay estuaries. Limiting factors for Thalassia growth appear to be temperature, water depth, turbidity, salinity and wave action (Monroe, 1963). This species is the dominant seagrass on the bait shrimping areas of the west coast of Florida (Moore, 1963), although there is no offshore growth in the Tampa-St. Petersburg area (Phillips, 1960). It has been reported that salinities below 20 ppt will have a negative effect on Thalassia beds (Moore, 1963).

Thalassia forms a growth association with the other marine grasses, with Halodule in the intertidal zone, Ruppia at a slightly lower level, Thalassia below low tide line and Syringodium at deeper levels than Thalassia. Halophila is often found mixed in with the grass beds of these latter two Genera (Phillips, 1960a,b).

The creeping, monopodial growth characteristic of Thalassia is an adaptive advantage for this organism on uniform, loose substrates. It is also well suited for areas subject to heavy silting since the rhizome apex has an upward growth form and new rhizomes are formed as lateral shoots at each higher level assumed by the rhizome. Continuous growth is, in fact, dependent on these rhizome apices, since no meristematic (embryonic) tissue is left behind and, therefore, isolated fragments are incapable of regeneration (Tomlinson and Vargo, 1966).

Tomlinson (1969) illustrated that Thalassia has roots that are adapted as organs of absorption. Patriquin (1972) determined that these roots were capable of obtaining from the sediments significant phosphate and all nitrogen required for growth. Further, he indicated that this nitrogen was primarily a result of nitrogen fixation by an anaerobic bacteria and that such a reducing substrate was necessary for optimal growth of Thalassia.

Zooplankton and Meroplankton - The zooplankton are the assemblage of small animals of open waters that are incapable of moving against a current and, therefore, depend in large part upon water flow for their distribution. They are generally secondary (or higher) consumers in the community deriving their nutrition either as predators, feeding on other zooplankton; herbivores, feeding on organic breakdown products of plants and animals; or omnivores, feeding on more than one energy source (Wetzel, 1975). Meroplankton are the planktonic larvae of benthic macroinvertebrates.

Most zooplankton are filter feeders, removing particulate matter from the water. The feeding effectiveness of herbivorous zooplankton is dependent upon algal density. At low densities insufficient food is caught and at high densities the algae may clog the filter apparatus and inhibit ingestion rates. Some species of algae may release toxins that inactivate the feeding apparatus of the zooplankton (Wetzel, 1975). Much of algal productivity enters the detrital pathway and so transfer of food is "short circuited" through bacteria and particulate detrital organic matter which can then be utilized by filter feeders. All zooplankton populations in turn regulate and are regulated by populations of planktivorous fish and other aquatic animals. Zooplankton are the crucial link in the food web between the phytoplankton and most other consumers, such as young fish and shellfish. The common freshwater zooplankton that occur are Rotifera and two subgroups of Crustacea, the Cladocera, and the Copepoda. In addition, in the estuaries, very large numbers of immature stages of fish and shellfish occur as zooplankton.

The most significant fluvial zooplankton are usually the Rotifera (rotifers), which include both omnivorous and sessile forms. The size of the majority of food consumed by rotifers is small so that large algae or other plankton may not be eaten or may be of reduced value. Factors affecting seasonal fluctuations in rotifers include both food availability and temperature, with highest populations occurring during mid or late summer. It has been generally accepted that the presence of several closely related species within one genus or the occurrence of several dominant genera may be indicative of an eutrophic system (Winner, 1975).

The major zooplankton species occurring in the Tampa Bay region are listed in Table I.6-13. Those species occurring most commonly are the

TABLE I.6-13

ZOOPLANKTON CHARACTERISTIC OF THE ESTUARIES IN THE STUDY AREA

Copepoda

- *Oithona colcarva*
- *Oithona nana*
- *Oithona simplex*
- *Acartia tonsa*

- *Paracalanus crassirostrus*
- *Paracalanus quasimodo*
- *Centropages hamatus*
- *Centropages furcatus*

- *Evadne tergastina*

- *Pseudodiaptomus Coronatus*

- *Euterpina Acutifrons*

- *Labidocera Aestiva*

Cladocera

- *Penilia avirostris*
- *Pudon polyphemoides*

Decapoda
- *Lucifer faxoni*

Chetognatha
- *Sagitta tenuis*
- *Sagitta hispida*

Tunicata

- *Oikopleura dioica*

Trachymedusa

- *Liriope tetraphylla*

Rotifera

- *Synchaeta*
- *Trichocerca*
- *Pseudonotholca*
- *Proales*

Copepods, *Oithona colcarva*, *Acartia tonsa* and *Paracalanus crassirostris* and a tunicate larva, *Oikopleura dioica* (Hopkins, 1977). As summarized in Table I.6-14, the zooplankton of the Tampa Bay region attain their highest numbers in the warmer months of fall, spring and summer ($\bar{x}$ of 102,733 organisms/m^3) with the winter reducing the numbers to under 13,000/m^3. The Copepods, however, comprise over 60 percent of the zooplankton during each sampling period. In addition to temporal variations, which are largely temperature dependent, spatial variations also occur in the study area, as illustrated in Table I.6-15. These variations in distribution suggest some correlation between the lower salinities and total zooplankton abundance, and an inverse correlation appears evident between photosynthetic pigments and zooplankton biomass. In addition, this table suggests that the highest number of zooplankton occurs in the region of the Old Tampa Bay and the lowest in Upper Tampa Bay for the three areas investigated.

The meroplankton, or "temporary" plankton, (Table I.6-16) represent larval stages of benthic invertebrates and comprise an important component of the zooplankton, with greatest numbers occurring in the spring and summer. Most of the meroplankton in the Hillsborough Bay and Old Tampa Bay are larvae of molluscs (bivalves and gastropods), although polychaetes (segmented worms) and decapods (crustacea) also form significant components of the estuarine community. In studies of the meroplankton in the Upper Tampa Bay area (TECO, 1977), it was shown that 94 percent of this community consisted of decapod crustaceans; these crustaceans comprised 86 of the 105 taxa collected for these investigations. The most abundant species represented were *Pinnixia sayana*, *Polyonyx gibbesi*, *Upogebi affinis* and *Neopanope texana* and the only species of commercial importance that was common was the stone crab, *Menippe mercanaria*.

TABLE I.6-14

SEASONAL ABUNDANCE OF ZOOPLANKTON IN ESTUARIES OF TAMPA BAY - NUMBERS REPRESENT WEIGHTED MEANS FOR EACH OF SEVEN SECTIONS OF THE BAY (MODIFIED AFTER HOPKINS, 1977)

	Fall	Winter	Spring	Summer
Temperature (Average)	24°C	16.3°C	27°C	29.6°C
Zooplankton (No./m^3)	93,100	12,700	106,500	108,600
Meroplankton (No./m^3)	7,800	3,300	25,200	17,200
Total Copepods (Percent of total Copepods as Nauplii)	58,800 (61%)	7,800 (64%)	71,700 (47%)	69,200 (28%)
Percent of Total Zooplankton as Copepods	63%	61%	67%	64%
Percent of Total Zooplankton as Meroplankton	8%	26%	24%	16%
Bivalve Larvae	4,200	1,200	15,500	5,300
Gastropod Larvae	360	40	2,000	3,300
Decapod Larvae	30	0	190	90
Polychaete Larvae	1,000	370	670	3,800

TABLE I.6-15

ZOOPLANKTON DISTRIBUTION IN ESTUARIES OF STUDY AREA, AS RELATED TO SALINITY AND PHOTOSYNTHETIC PIGMENTS (MODIFIED AFTER HOPKINS, 1977)

Estuarine Area	Salinity (ppt)	Chlorophyll a + Phaeopigments (mg/m^3)	Zooplankton Biomass (mg/dry wt/m^3)	Total Meroplankton (median no./m^3)	Total Copepods (median no./m^3)	Total Zooplankton (no./m^3)	Percent Zooplankton as Copepods
Hillsborough Bay	19.5	53.6	43.4	17,109	51,464	103,000	50%
Old Tampa Bay	21.0	11.3	70.2	17,107	100,462	110.000	91%
Upper Tampa Bay	23.3	15.1	33.9	18,756	53,163	76,000	70%

TABLE I.6-16

MEROPLANKTON CHARACTERISTIC OF UPPER TAMPA BAY

Species
Pagurus longicarpus
Sesarma cinereum
Sesarma reticulatum
Processa sp.
Rithropanopeus harrisii
Palaemonetes intermedius
Libinia dubia
Squilla sp.
Neopanope packardii
Periclimenes americanus
Palaemonetes pugio/vulgaris
Pinnixa sayana
Polyonyx gibbesi
Upogebia affinis
Neopanope texana
Hexapanopeus angustifrons
Pinnixa chaetopterana
Balanus sp.
Ambidexter symmetricus
Eurypanopeus depressus
Uca sp.
Menippe mercenaria
Pinnotheres maculatus
Persephona punctata
Ogyrides limicola
Latreutes parvulus
Panopeus herbstii
Petrolisthes sp.
Palaemon floridanus
Callianassa sp.
Tozeuma carolinense
Pagurus annulipes
Penaeus duorarum
Euceramus praelongus
Aegathoa sp.
Leptochela serritorbita
Branchiostoma caribaeum
Periclimenes longicaudatus
Limulus polypheums
Thor floridanus
Hippolyte zostericola
Pagurus pollicaris
Alpheus heterochaelis
Porcellana sayana
Leander sp.
Naushonia sp.
Callinectes sapidus

Source: TECO (1977)

The Cladocera (commonly known as "water-fleas") are almost all filter feeders and feed upon particles as small as bacteria. The Copepoda (copepods) are variable in their feeding. Some are selectively predatory while others are true filter feeders. Although most copepods are littoral benthic species, the few that are planktonic may form a major part of the zooplankton community with their main diet being phytoplankton (Barnes, 1974)

Both cladocera and, to a lesser extent, copepods, have an ability to select food, with many small algae being ingested and gelatinous green algae or large unpalatable species being rejected. Where these algae dominate, the filtering rates of these zooplankton are usually reduced; and if blue-green algae dominate the phytoplankton, the rates of ingestion, assimilation, survivorship and reproduction of cladocera are known to decrease (Wetzel, 1975).

Benthic Macroinvertebrates - Benthic macroinvertebrates are bottom dwelling organisms which live all or part of their life cycles in and upon various underwater substrates. These organisms are large enough to be retained by a U.S. Standard Number 30 seive and may be recognized by the unaided eye (USEPA, 1973).

Benthic macroinvertebrates are important in the aquatic ecosystem because of the very diverse nature of their trophic relationships. Macroinvertebrates occupy virtually all levels of the trophic web. They include carnivores, herbivores and omnivores as well as deposit and detritus feeders, scavengers, parasites, grazers and predators.

Macroinvertebrates play an imiportant role in the recycling of nutrients in the aquatic system and in supplying a food source for other organisms in the food web. Macroinvertebrates also represent an important food source for fish and often included among these invertebrates are species of both commercial and recreational importance.

The makeup of the macroinvertebrate community varies in response to both the biotic and abiotic factors of its environment. Variations in this community occur both spatially and temporally. Factors such as water temperature, velocity, substrate type, presence of chemical substances, presence of other biota (especially habitat forming macrophyte plants) and water quality all affect macroinvertebrate distribution. In estuaries, temperature, salinity, wave shock, turbidity, tidal exposure and substrate are most important in affecting the structure of the benthic community. Evaluation of a macroinvertebrate community requires analyses of species presence, density and community structure. The presence of a species may be controlled by any of the factors mentioned above or, in addition, by tolerance to chemical conditions, competitive interactions with other organisms or simply by the lack of opportunity to invade a particular habitat. The density or abundance of a particular species is indicative of the relative fitness of an organism for a particular environment and a measure of its success in utilizing community resources.

The structure of an aquatic community is particularly important since it represents a metabolically interrelated level of organization (Odum, 1971). The community level of an ecosystem has both diversity and structure which may be examined in part through the use of diversity indices. These indices take into account two prime components of community structure: richness of species and the distribution of individuals among species. Generally, high diversities are associated with unpolluted, unstressed communities while low diversities are usually associated with stressed or polluted communities.

In the lotic ecosystems of the Planning Area, considerable variation occurs among benthic invertebrate communities. Upstream, swamp-forest areas typically are dominated by molluscs, such as Corbicula manilensis, and larval insects, particularly mayflies (Ephemeroptera) and dragon- and damselflies (Odonata). In slower moving water associated with downstream habitats, damselflies (Odonata) and chironomids (diptera) are abundant, especially in vegetated areas. Sphagnum bogs, where they occur, often contain many unique species and should be afforded status of special habitats to be preserved (Cowell, 1976).

In estuarine areas of low salinity, such as the marsh and mangrove areas along or near the river mouths, common invertebrates include grass shrimp (Palaemonetes), fiddler crabs (Uca), bivalve molluscs (e.g. Mercenaria), amphipods (e.g. Capreila), Polychaetes (e.g. Neanthes) and marsh snails (e.g. Littorina). Along the hard substrates of mangrove roots and rocks, attached species predominate, such as Oysters (Ostrea), mussels (e.g. Modiolus), barnacles (Balanus) and slipper snells (Crepidula). Wood surfaces are typically inhabited by boring species, such as the shipworm (Teredo). In the oyster bar communities found in Old Tampa Bay and Hillsborough Bay, many sessile organisms occupy areas among the oysters, such as Ectoprocts (Bubula) and mussels (Brachidontes). The substrates of the open waters of the bays in the Planning Area support a variety of invertebrates, such as blue crabs (Callinectes), white and brown shrimp (Palaemonetes), Polychaetes (e.g. Chaetopterus), Urchins (Lytechinus) and horseshoe crabs (Limulus) (Collard and D'Asaro, 1993).

The benthic invertebrate surveys conducted for Tampa Electric Company (TECO, 1977) included a collection of 352 species in the Upper Tampa Bay area (Table I.6-17). The dominant species were bivalves, Mysella planulata and a

TABLE I.6-17

BENTHIC MACROINVERTEBRATES OF UPPER TAMPA BAY

Cnidaria
Hydrozoa
Campanularidae
Clavidae
Eudendridae
Anthozoa
Alcyonaridae
Edwardsia sp.
Platyhelminthes
Euplana gracilis
Stylochus sp.
Nemertinea
Annelida
Polychaeta
Aglaphamus verilli
Ameana trilobata
Ampharetidae (juv.)
Amphicteis gunneri
Ancistrosyllis jonesi
Apoprionospio pygmaea
Arenicola cristata
Aricidea sp.
Asychis sp.
Autolytus sp.
Branchidasychis americana
Brania clavatum
Capira inserta
Capitella capitata
Caulleriella sp.
Chaetopterus variopedatus
Chaetozone setoba
Chune sp.
Cirriformia grandis
Cirkatulus sp.
Cirrophorus sp.
Clymenella mucosa
Clymenella torquata calida
Ctenodrilus serratus
Diopatra cuprea
Drilonereib longa
Eteone heteropoda
Eumida sanguinea
Eunice sp.
Exogone sp.
Fabricia sabella
Glycera americana
Glycinde bolitaria
Gyptis vittata
Harmothde sp.
Hesione picta
Hypsicomus phaeotaenia
Isolda pulchella
Laeonereis culveri
Lumbrineris coccinea
Magelona pettiboneae
Maldane sarsi
Malacoceros sp.
Marphysa sanguinea
Mediomastus californiensis
Megalomma bioculatum
Melinna maculata
Melinnopsis allantica
Mesochaetopterus sp.
Minuspio cirrifera
Naineris, near laevigata
Nereis succinea
Notomastus hemipodus
Notomastus latericeus
Odoniosyllis sp.
Onuphis sp.
Ophryotrocha fuerilis
Paleonotus hereoseta
Parahesione luteola
Paraprionospino pinnata
Pareurythoe americana
Pectinaria gouldii
Pherusa arenosa
Phylloduce arenea
Phyllodoce fragilis
Phylo ornatus
Priomis eruca
Pista cristata
Pista palmata
Podarke obscura
Poecilochaetus johnsoni
Polycirrus eximius
Polydora ligni
Polydora socialis
Prionospio heterobranchia

TABLE I.6-17 (Cont.)

Pseudeurythoe ambigue
Pseudopolydora
Schistomeringos longicornus
Scolelepis sp.
Scoloplos foliosus
Scoloplos robustus
Scoloplos rubra
Sigambra tentaculata
Spio pettiboneae
Spiochaetopterus costarum
Stenoninereis martini
Sthenelais boa
Streblospio benedicti
Syllis gracilis
Terebella rubra
Travisia hobsonae
Tharyx sp.
Typosyllis sp.
Mollusca
Bivalvia
Abra aequalis
Amygdalum papyrium
Anadara transversa
Brachiodontes exustus
Corbula contracta
Corbula swiftiana
Crassinella lunulata
Crassostrea virginica
Cyclinella tenuis
Cyrtopleura costata
Dosinia discus
Ensis directus
Ischadium recurvum
Laevicardium mortoni
Montacuta sp.
Parvilucina multilineata
Lyonsia hyalina floridana
Macoma tenta
Mercenaria campechiensis (juv.)
Modiolus sp.
Mulinia-mactra
Musculus lateralis
Nucula crenulata
Ostrea equestris
Parastarte triquetra
Cyrenoida florida
Semele profica
Sphenia antillensis
Tagelus divisus
Tagelus plebius
Tellina lineata
Tellina versicolor
Mysella planulata
Semele purpurascens
Gastropoda
Acteocina canaliculata
Acteon punctostriatub
Anachis oresa
Daecum pulchellum
Circulus suppressus
Drepidula plana
Dydlostremiscus sp.
Doridacea
Doto sp.
Elysia sp.
Epitonium angulatum
Epitonium foliaceicostum
Epitonium humphreysi
Epitonium rupicola
Eupleura sulcidentata
Manindea
Melanella sp.
Melongena cordna
Mitrella lunata
Natica pusilla
Odostomia impressa
Oliva sayana
Olivella perplexa
Polinices duplicatus
Pronum apicinum
Pyramidella sp.
Sinum perspectivum
Sporilla sp.
Strombiformis hemphilli
Teinostoma sp.
Terebra sp.
Triphora sp.
Turbonilla conradi
Turbonilla hemphilli
Urosalpinx sp.
Arthropoda
Xiphosura
Limulus polyphemus
Amphipoda
Acanthohaustorius sp.
Ampelisca vadorum

TABLES I.6-17 (Cont.)

Ampelisca verrilli
Argissa sp.
Batea catharinensis
Cerapus sp.
Corophium sp.
Cymadusa sp.
Elasmopus levis
Erichtonius
Gammarus mucronatus
Gitanopsis sp.
Grandiderella bonnieroides
Lembos smithi
Leucothoe sp.
Listriella
Lysianopsis alba
Melita appendiculata
Melita nitida
Microdeutopus sp.
Monoculodes nyei
Parametopella cypris
Paraphoxus
Photis pugnator
Podocerus sp.
Rudilemboides naglei
Stenothoe sp.
Trichophoxus floridanus
Leptostraca
Nebalia
Isopoda
Aegathoa oculata
Apanthura magnifica
Cyathura polita
Cymodode Faxoni
Edotea montosa
Erichsonella filiformis
Munna sp.
Sphaeroma quadridentatum
Xenanthura brevitelson
Cumacea
Cumella Garritii
Cyclaspis varians
Leucon acutirostris
Oxyurostylis smithi
Mysidacea
Mysidopsis regelowi
Tanaidacea
Ostracoda
Haplocytherida setipunctata
Parasterope pollex
Sarsiella tricostata
Sarsiella zostericola
Copepoda
Temora sp.
Cirripedia
Balanus sp.
Stomatopoda
Squilla empusa
Decapoda
Alpheus heterochaelis
Callinectes sapidus
Euceramus praelongus
Eurypanopeus depressus
Hexapanopeus augustigrons
Latreutes parvulus
Leptodius sp.
Leptochela sp.
Lucifer faxoni
Menippe mercenaria
Neopanope texana texana
Ogyrides limicola
Pagurus annulipes
Pagurus longicarpus
Paleomoneteb sp.
Panopeub herbbtii
Penaeus dooraroa
Periclimenes americanus
Persephona sp.
Petrolisthes galathinus
Pinnixa sp.
Pinnotheres sp.
Polyonx gibbesi
Ambidexter sp.
Tozuema carolinense
Trachypeneus constrictus
Upogebia sp.
Phoronida
Phoronis architecta
Bryozoa
Bugula sp.
Electra sp.
Brachiopoda
Glottidia pyramidata
Echinodermata
Ophiuroidea
Amphioplus abditus
Amphioplus thrombodes
Amphipholis atra

TABLE I.6-17 (Cont.)

Amphipholis gracillima
Amphipholis squamata
Hermipholis elongata
Ophiophragmus filograneus
Holotruroidea
Leptosynapta sp.
Unid. sp.
Hemichordata
Chordata
Urochordata
Bostrichobranchus pilularis
Molgula sp.
Styela plicata
Cephalochordata
Branchiostoma caribaeum
Pisces
Achirus lineatus
Gobiosoma robustum
Hypsoblennius hentzi
Myrophis punctatus
Menidia beryllina
Menticirrhus americanus
Microgobius gulossus
Prionotus tribulus
Sciaenidae
Symphurus plagiusa

Mullina-mactra complex; a polychaete, *Psyudopolydora* sp.; and several arthropod species, including: *Ampelisca vadorum*, *A. verrilli*, and *Rudilemboides nagle*, (Amphipods); *Parasterope pollex* and *Haplocytherida setipunctata* (Ostracods); and *Cylaspis varians* (Cumacea). Additionally, as part of an impingement investigation conducted for the TECO study, it was demonstrated that the dominant neritic taxa in this area of the bay are pink shrimp (*Penneus duorarum*), blue crab (*Callinectes sapidus*), horseshoe crab (*Limulus polyphemus*), a portunid crab (*Portunus gibbesii*), brief squid (*Lolliguncula brevis*) and mantis shrimp (*Squilla empusa*) (Table I.6-18).

Table I.6-19 lists characteristic benthic macroinvertebrates found in the Planning Area.

Fish and Ichthyoplankton - Fish are among the most important organisms in the aquatic ecosystem, both to man and to the aquatic system itself. Fish species occupy a wide variety of trophic levels as consumers and predators as well as detrital feeders and herbivores. Fish also have the longest reproductive cycle of any of the major aquatic organisms and are also generally the most fragile.

The distribution of fish species along coastal rivers is largely determined by salinity although both marine and freshwater species may occur for many miles upstream. Tributary creeks along the lower stretch of these coastal rivers provide areas of intermediate salinity where fish can undergo gradual transition from salt to fresh water (Tagatz, 1968).

McLane (1955) characterized fish species by salt tolerance and used the following categories:

1. *Primary Freshwater Species*: Those species that spend their entire life history in freshwater. The most important family in this category

TABLE I .6-18

MACROINVERTEBRATES OBTAINED BY IMPINGEMENT STUDIES IN UPPER TAMPA BAY

- *Aurelia aurita*
- *Chrysura quinquecirrha*
- *Aplysia willcoxi*
- *Lolliguncula brevis*
- *Squilla empusa*
- *Limulus polyphemus*
- *Penaeus duorarum*
- *Trachypenaeus constrictus*
- *Alpheus heterochalis*
- *Upogebia* sp.
- *Petrolisthes armatus*
- *Petrolisthes* sp.
- *Pagurus longicarpus*
- *Portunus gibbesii*
- *Callinectes ornatus*
- *Callinectes sapidus*
- *Menippe mercenaria*
- *Hexapanopeus angustifrons*
- *Neopanope texana texana*
- *Eurypanopeus depressus*
- *Panopeus herbstii*
- *Sesarma cinerium*
- *Sesarma reticulatum*
- *Libinia dubia*
- *Mogula* sp.

Source: TECO, 1977

TABLE I.6-19

BENTHIC MACROINVERTEBRATES ASSOCIATED WITH THE AQUATIC AND ESTUARINE ECOSYSTEMS OF THE PLANNING AREA

- Nematoda
- Mollusca
  - Gastropoda
    - *Amnicola* sp.
    - *Cylichna* sp.
    - *Goniobasis* sp.
    - *Helisoma* sp.
    - *Littorina* sp.
    - *Lunatia* sp.
    - *Melongena* sp.
    - *Odostomia* sp.
    - *Physa* sp.
    - *Viviparus* sp.
    - Valvatidae
  - Bivalvia
    - *Alasmidonta* sp.
    - *Amygdalum* sp.
    - *Corbicula* sp.
    - *Modiolus* sp.
    - *Nucula* sp.
    - *Periploma* sp.
    - *Rangia* sp.
    - *Sphaerium* sp.
    - *Tagelus* sp.
    - *Mysella* sp.
  - Cephalopoda
    - *Lollinguncula* sp.
- Annelida
  - Obligochaeta
  - *Tubifex* sp.
  - Hirudinea
  - Polychaeta
    - *Capitella*
    - *Nereis* sp.
    - *Streblospio* sp.
    - *Pseudopolydora* sp.
    - *Palaprionospio* sp.
    - *Minuspio* sp.
    - *Tharyx* sp.
- Arthropoda
  - Chelicerata
    - *Limulus*
  - Crustacea
    - Amphipoda
      - *Caprella* sp.
      - *Ampelisca* sp.
      - *Rudilemboides* sp.
    - Cirripedia
      - *Balanus*
    - Decapoda
      - *Sicyonea* sp.
      - *Callinectes* sp.
      - *Labinia* sp.
      - *Uca* sp.
      - *Menippe* sp.
      - *Squilla* sp.
      - *Penaeus* sp.
      - *Palaemonetes* sp.
      - *Penaeus* sp.
      - *Ambidexter* sp.
      - *Callianassa* sp.
      - *Upogebia* sp.
      - *Polyonyx* sp.
      - *Portunas* sp.
      - *Trachypeneus* sp.
    - Isopoda
    - Thoracica
      - *Balanus* sp.
    - Ostracoda
      - *Parasterope* sp.
      - *Haplocytherida* sp.

TABLE I.6-19 (Cont.)

Hexapoda

Ephemeroptera

Baetinae
Brachycerus sp.
Caenis sp.
Callibaetis sp.
Neocloeon sp.
Pseudocloeon sp.

Odonata

Aphysila sp.
Macromia sp.

Megaloptera
Trichoptera
Coleoptera
Dubiraphia sp.
Stenelmis sp.
Peltodytes sp.

Urochordata
Molgula sp.

Diptera

Ceratopogonidae
Palpomyia sp.
Culicidae
Simulidae
Chironomidae

Chironomous sp.
C. attenuatus
C. stigmaterus
C. (Cryptochironomus) sp.
C. (Cryptochironomous) sp.
C. (Einfeldia) sp.
C. (Limnochironomus) sp.
C. (Limochironomous) nervosus
C. (Limnochironomus) modestus
Clinotanypus sp.
C. thoracicus
Corynoneura sp.
C. (Corynoneura) scutellata
C. (Corynoneura) taris
C. (Thienemanniella) sp.
C. (Thienemanniella) similis
C. (Thienemanniella) xena
Cricotopus sp.
C. bicinctus
Cryptotendipes sp. Beck
Eukiefferiella sp.
E. brievinervis
E. brevistylus
Glyptotendipes sp.
G. senilis
Harnischia sp.
H. edwardsi
Paracladopelma sp.
P. loganae
Paralauterborniella sp.
P. nigrohalteralis
Pentaneura sp.
P. carnea
P. inculta
P. Monilis
P. (Ablabesmyia) auriensis
P. (Ablabesmyia) mallochi
P. (Labrundinia) sp.
P. (Labrundinia) virescens
Polypedilum sp.
P. convictum
P. halterale
P. illinoense
P. ophioides
P. scalaenum
Procladius sp.
P. culiciformis
P. sublettei
P. (Cryptotendipes) sp.
Psectrocladius sp.
Stenochironomus hilaris
Tanytarsus sp.
T. nigripilus
T. polita
T. (Micropsectra) sp.
Tanypus punctipennis
T. stellatus
Trichocladius sp.

Source: Dragovich and Kelly, 1964
Saloman, 1964
Hall, 1972

is the sunfish. Shad and gar are also included, but they are also found in brackish water.

2. *Marine Invaders*: Forms that enter both fresh and saltwater during part of their life history.

3. *Anadromous*: Marine forms that return to freshwater to spawn. The most important group is the shad (American shad, hickory shad).

4. *Catadromous*: Those fish that live generally in freshwater but migrate to coasts or open sea to spawn. The American eel is the most notable species in this group, while striped mullet could be placed between catadromous and the following amphidromous category.

5. *Amphidromous*: Species that migrate but not for breeding purposes. Species included in this category are ladyfish, bay anchovy and sturgeons.

6. *Non-migrating*: Euryhaline species. Striped bass and stingrays are included in this category.

Table I.6-20 lists the fish characteristic of the aquatic and estuarine ecosystems of the Planning Area.

The fish species found in freshwater which is not influenced by tidal activity vary primarily with type of substrate, stream flow characteristics, water depth, turbidity, chemical properties, available vegetation and food. Those species exhibiting broad tolerances (Euryeclous) for most physico-chemical characteristics, and, therefore, are common in most freshwater ecosystems in the Planning Area include Mosquito fish *(Gambusia)*, Shiners *(Cyprinidae)*, Sunfish *(Lepomis)* and Sailfin molly *(Poecilia)*. In addition, occasional exotic species occur, primarily by accidental release from the hundreds of tropical fish farms in the Planning Area. In brackish waters, near

TABLE I.6-20

FISH CHARACTERISTIC OF THE AQUATIC AND ESTUARINE ECOSYSTEMS IN THE PLANNING AREA

Family Common Name	Scientific Name
Carcharhinidae-requiem sharks	
Bull shark	*Carcharhinus leusca*
Black tip shark	*Carcharhinus limbatus*
Carchariidae	
Mako	*Carcharias tarus*
Dasyatidae-stingrays	
Bluntnose stingray	*Dasyatis sayi*
Sting ray	*Dasyatis sabina*
Smooth butterfly ray	*Gymnura micrura*
Myliobatidae-eagle rays	
Cownose ray	*Rhinoptera bonasus*
Lepisosteidae-gars	
Longnose gar	*Lepisosteus osseus*
Florida gar	*Lepisosteus platyrhincus*
Elopoidae-tarpons	
Layfish	*Elops saurus*
Tarpon	*Megalops atlantica*
Anguillidae-freshwater eels	
American eel	*Anguilla rostrata*
Ophichtayidae-snake eels	
Speckled eel worm	*Myrophis punctatus*
Muraenidae	
Moray	*Gymnothorax saxicola*
Clupeidae-herrings	
Yellowfin menhaden	*Brevoortia smithi*
Threadfin	*Brevoortia patronus*
	Opisthonema oglinum
Threadfin shad	*Dorosoma petenense*
White minnow	*Harengula pensacolae*
Scaled sardine	*Harengula jaguanae*
Engraulidae-anchovies	
Bay anchovy	*Anchoa mitchille*
Glass minnow	*Anchoa hepsetus*
Glass minnow	*Anchoa cubana*

TABLE I.6-20 (Continued)

Family	
Common Name	Scientific Name
Gobiesocidae-clingfishes	
Skilletfish	Gobiesox strumosus
Esocidae-pikes	
Redfin pickerel	Esox americanus americanus
Synodontidae-lizardfishes	
Inshore lizardfish	Synodus foetens
Cyprinidae-minnos	
Golden shiner	Notemigonus crysoleucas
Sailfin shiner	Notropis hypselopterus
Coastal shiner	Notropis petersoni
Catostomidae-suckers	
Lake chubsucker	Erimyzon sucetta
Ictaluridae-freshwater catfishes	
Yellow bullhead	Ictaluras natalis
Brown bullhead	Ictalurus nebulosus
Tadpole madtom	Noturus gyrinus
Ariidae-sea catfishes	
Sea catfish	Aris felis
Gafftopsail catfish	Bagre marinus
Hardhead catfish	Galeichthys felis
Aphredoderidae-pirate perches	
Pirate perch	Aphredoderus sayanus
Batrachoididae-toadfishes	
Gulf toadfish	Opsanus beta
Belonidae-needlefishes	
Atlantic needlefish	Strongylura marina
Redfin neddlefish	Strongylura notata
Neddlefish	Strongylura timucu
Hemirhamphidae	
Hound minnow	Hyporhanphus unifasciatus
Cyprinodontidae-fillfishes	
Sheepshead minnow	Cyprinodon variegatus
Golden topminnow	Fundulus chrysotus
Gulf Killifish	Fundulus grandis
Striped killifish	Fundulus majalis
Seminole Killifish	Fundulus seminolis
Longnose Killifish	Fundulus similis

TABLE I.6-20 (Continued)

Family Common Name	Scientific Name
Flagfish	Jordanella floridae
Bluefin killifish	Lucania goodei
Rainwater killifish	Lucania parva
Chub	Floridichthys carpio
Peociliidae-liverbearers	
Mosquitofish	Gambusia affins
Sailfin molly	Poecilia latipinna
Syngnathidae	
Seahorse	Hippocampus evectus
Seahorse	Hippocampus hudsonium
Dwarf seahorse	Hippocampus zposterae
Pencil fish	Syngnathus scovelli
Pencil fish	Syngnathus floridae
Pencil fish	Syngnathus louisaneae
Pencil fish	Micrognathus cringerus
Gadidae	
____________	Urophycis floridanui
Atherinidae-silversides	
Brook silverside	Labidesthes sicculus
Tidewater silverside	Menidia beryllina
Glass minnow	Membras sp.
Centropomidae-snooks	
Snook	Centropomus undecimalis
Centrarchidae-sunfishes	
Everglades pygmy sunfish	Elassoma evergladei
Bluespotted sunfish	Enncacanthus gloroisus
Redbreat sunfish	Lepomis auritus
Warmouth	Lepomis gulosus
Bluegill	Lepomis macrochirus
Dollar sunfish	Lepomis marginatus
Redear sunfish	Lepomis microlophus
Spotted sunfish	Lepomis pumctatus
Florida largemouth bass	Microterus salmoides floridanum
Black crappie	Pomoxis nigromaculatus
Pomatomidae	
Bluefish	Pomatomus saltatrix

TABLE I.6-20 (Continued)

Family Common Name	Scientific Name
Percidae-perches	
Swamp darter	Etheostoma fusiforme
Carangidae-jacks and pompanos	
Blue runner	Caranx crysos
Hardtan jack	Caranx latus
Crevalle jack	Caranx hippos
Atlantic bumper	Chloroscombrus chrysurus
Leatherjacket	Oligoplites saurus
Pompano	Trachinotus falcatus
Lookdown	Selene vomer
______________________	Hemicaranx amblyrhynchus
Lutjanidae-snapper	
Red snapper	Lutjanus campechanus
Gray snapper	Lutjanus grisgus
Lane snapper	Lutjanus synagris
Pomadasyidae	
______________________	Bathystoma aurolineatum
Grunt	Orthopristis chrysoptera
Gerreidae-mojarras	
Striped mojarra	Diapterus plumieri
Spotfin mojarra	Eucinostomus argentenus
Sand peach	Eucinostomus gula
Aparidae-porgies	
Sheepshead	Archosargus probatocephalus
Pinfish	Lagodon rhomboides
Spot tail	Diplodus holbrooks
Sciaenidae-drums	
Southern kingfish	Menticirhus saxatilis
Silver pearch	Bairdiella chrysura
Sand seatrout	Cynoscion arenarius
Spotted seatrout	Cynoscion nebulosus
Spot	Leiostomus xanthurus
Southern kingfish	Menticirrhus americanus
Atlantic croaker	Micropogon undulatus
Black drum	Pogonias cromis
Red Drum	Sciaenops ocellata
Whiting	Menticirrhus focaliger
Uranoscopidae	
Electric stargazer	Astroscopus ygraecum

TABLE I.6-20 (Continued)

Family Common Name	Scientific Name
Ephippidae-spadefishes	
Atlantic spadefish	Chaetodipterus faber
Mugilidae-mullets	
Striped mullet	Mugil cephalus
Black mullet	
________	Mugil curema
Silver Mullet	Mugil trichodon
Triglidae	
Sea robin	Prionotus scitulus
Sea robin	Prionotus tribulus
Gobiesocidae	
________	Gobiesox strumosus
Bothidae	
________	Paralichthys lethostigma
Gobiidae-gobies	
Code goby	Gobiosoma robustum
Vlown goby	Microgobius gulosus
________	Bathygobius sporator
________	Gobiosoma bosci
Blennidae	
________	Hypsoblennius hentzi
Little dogfish	Chasmodes saburrae
Scombridae-mackerels	
Spanish mackerel	Scomberomorus maculatus
Soleidae-soles	
Hogchocker	Trinectes maculatus
Flounder	Achirus lineatus
Aluteridae	
Filefish	Monocanthus hispidus
Cynoglossidae-tonguefishes	
Blackineer tonguefish	Symphurus plagiosa
Ostraciidae	
Cowfish	Acanthostracion tricornis
________	Acanthostracion quadricornis

TABLE I.6-20 (Continued)

Family Common Name	Scientific Name
Diodontidae	
Porcupinefish	*Chilomycterus schoepfi*
Tetraodontidae-puffers	
Southern puffer	*Sphoeroides nephalus*
Blowfish	*Lagcocephalus laevigatus*
Pristidae	
Sawfish	*Pristis pectinatus*

Source: Springer and Woodburn, 1960; Finvcane, 1965; TECO, 1977 the mouth of most rivers, commonly occurring fish species are sand seatrout (Cynoscion), sea catfish (Aris), killfish (Fundulus), striped mullet (Mugil), bay anchovy (Anchoa), striped majarra (Diapterus) and tidewater silversides (Menidia). Those species that are commonly found in the open bays of the study area include Menhaden (Brevoortia), Scaled sardine (Harengula), bay anchovy (Anchoa), killfish (Fundulus), pencil fish (Syncnathus), spotfin Majarra (Eucinostomus), silver perch (Bairdiella), spot (Leiostomus), pinfish (Lagodon) striped mullet (Mugil), silverside (Menidia) and permit (Trachinotus). In an impingement study conducted for Tampa Electric Company (TECO, 1977) in Upper Tampa Bay, six species of fish were commonly collected: bay anchovy, silver perch, pinfish, sand seatrout, leopard searobin and atlantic bumper. In addition, red drum occurred as a seasonally abundant species.

The ichthyoplankton of Upper Tampa Bay were investigated as part of a power plant intake study (TECO, 1977) and 41 species of larval fish were collected. Although plankters were most abundant during spring and summer, spawning was evident year round. The spring and summer samples were dominated by bay anchovy eggs and larvae while winter samples were dominated by larvae of blennies and gobies. Seasonal distribution of these and other ichthyoplankton observed in this study are illustrated in Table I.6-21. Many of these estuarine species are abundant only during specific seasons and/or in certain areas of the Tampa Bay study area.

Aquatic Mammals - Although several aquatic mammals are occasional inhabitants of the coastal waters of the Planning Area, the most important species is the west indian manatee, Trichechus manitus latirostris.

The manatee is a large aquatic mammal and is listed as an endangered species by the Federal Government (USDI, 1977) and as threatened in the State of Florida (Florida DNR, 1978). Adaptations of the manatee for the aquatic

TABLE I.6-21

ICHTHYOPLANKTON CHARACTERISTIC OF UPPER TAMPA BAY

Ophichtyidae - snake eels

Myrophis punctatus - speckled eel worm

Clupeidae - herrings

Harengula jaguana - scaled sardine
Brevoortia sp.

Engraulidae - anchovies

Anchoa mitchilli - bay anchovy

Gobiesocidae - clingfishes

Gobiesox strumosus - skilletfish

Atherinidae - silversides

Syngnathidae - pipefishes

Carangidae - jacks-pompanos

Chloroscombrus chrysurus - Atlantic bumper
Oligoplites saurus - leatherjackets

Pomadasyidae - grunts

Orthopristis chrysoptera - pigfish

Sparidae - porgies

Archosargus probatocephalus - sheepshead
Logodon rhomboides - pinfish

Sciaenidae - drums

Bairdiella chrysura - silver perch
Cynoscion arenarius - sand seatrout
Cynoscion nebulosus - spotted seatrout
Leiostomus xanthurus - spot
Menticirrhus saxatilis - northern kingfish
Pogonias cromis - black drum

Blenniidae - combtooth blennies

Gobiidae - gobies

Triglidae - searobins

Prionotus sp.

Soleidae - soles

Achirus lineatus - lined sole

Cynoglossidae - tonguefish

Symphurus plagiusa - blackcheek tonguefish environment include forelimbs that are modified into flippers and a body that terminates in a broad, rounded tail. Manatees may reach a weight of up to 700 kilograms (1540 lbs.) and feed almost exclusively on aquatic macrophytes, although occasionally they will feed on fish (Morris, 1965).

The manatee is extremely sensitive to cold water, being susceptible to pneumonia at temperatures below 8° C. During the winter, this species has a range, along the Gulf Coast, that extends from the Crystal River south and into warm freshwater springs. During the warmer months these mammals move further north and have been observed as far west as the coast of Louisiana (USDI, 1977). The manatee is able to tolerate a wide range of salinities and often ranges well out to sea, although manatees do require fresh water for drinking (USDI, 1977).

The U.S. manatee population currently is between 750 and 1000 animals, up from a low of about 100 in the 1890s (Leahy and Lowery, 1979). Historically, however, major declines in the manatee population have occurred as a result of overharvesting for meat, oil and leather. In addition, many of these mammals are injured or killed each year due to accidents involving power boats (Florida DNR, 1977).

The manatee enjoys the unique status in Florida as the official state marine mammal. In addition, with the passage of the Manatee Sanctuary Act in June 1979, the entire State of Florida was established as a sanctuary and refuge for manatees (Florida DNR, 1979).

In the Planning Area, only the lower section of the Little Manatee River (downstream from Highway 301) is defined as a critical habitat for the manatee (USDI, 1977). Recent Florida legislation requires boat operators to maintain idle speed in these areas of critical manatee habitat (Florida DNR, 1979).

I.7 ARCHAEOLOGICAL, CULTURAL, HISTORICAL AND RECREATIONAL RESOURCES

I.7.1 Archaeological and Historical Sites

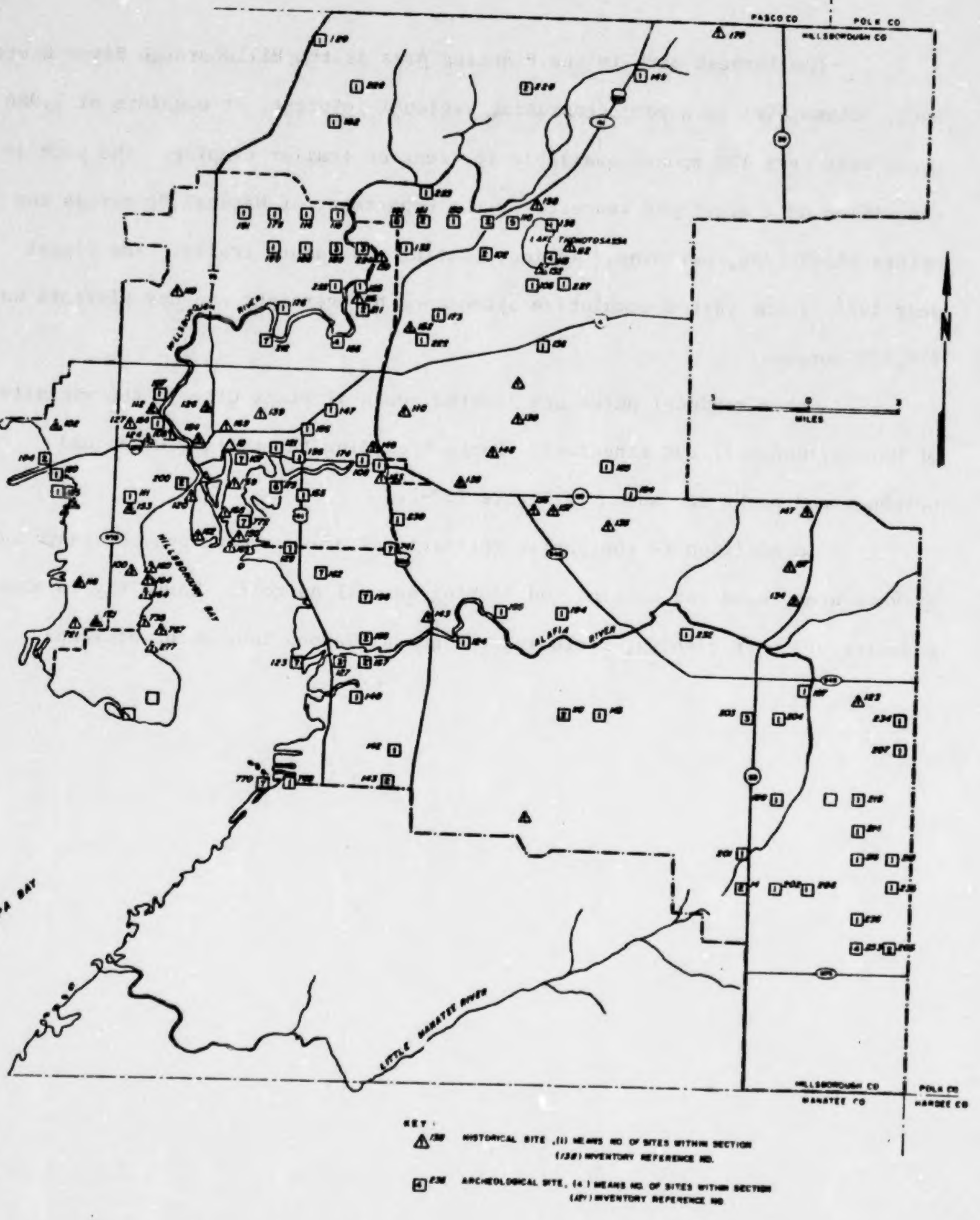
The Tampa Bay Area is rich in historical resources. The Planning Area includes the Alafia River, the Hillsborough River, numerous lakes and Tampa Bay.

The very diversity of factors which makes the Planning Area attractive for recreation probably made the area attractive to natives. Unfortunately, the development of Tampa has probably destroyed many aboriginal sites. It is likely that what undisturbed archaeological sites still remain in the Planning Area are outside the City of Tampa.

Figure I.7-1 shows archaeological and historical locations listed in the Division of Archives Inventory, Florida Department of State. The type of site, either historical or archaeological, is indicated, along with the number of sites within the one square mile section of the Inventory Reference number. The figure provides general locations of these sensitive areas. This information is to be used in the general routing of interceptors. Archaeological impacts of sewer system routing will be examined in greater detail in Volume II.

I.7.2 Parks and Recreation Areas

The Planning Area contains numerous lakes, several rivers, one bay and one state park. Hunting, fishing, swimming, campming and hiking are popular within the Planning Area. The Hillsborough River State Park is the major land area set aside for recreation; however, the use of the many lakes scattered throughout the Planning Area for swimming and water skiing should not be underestimated.


PASCO CO
POLK CO
HILLSBOROUGH CO
LAKE THONOTOSASSA
HILLSBOROUGH RIVER
HILLSBOROUGH BAY
TAMPA BAY
ALAFIA RIVER
LITTLE MANATEE RIVER
N
MILES
HILLSBOROUGH CO
POLK CO
MANATEE CO
HARDEE CO
KEY:
⚠ 138 HISTORICAL SITE, (1) MEANS NO OF SITES WITHIN SECTION (138) INVENTORY REFERENCE NO.
4 236 ARCHEOLOGICAL SITE, (4) MEANS NO. OF SITES WITHIN SECTION (271) INVENTORY REFERENCE NO.

DATA SOURCES: FLORIDA DEPARTMENT OF STATE, DIVISION OF ARCHIVES
INVENTORY OF HISTORICAL AND ARCHEOLOGICAL SITES.

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KNOWN HISTORICAL AND ARCHEOLOGICAL SITES

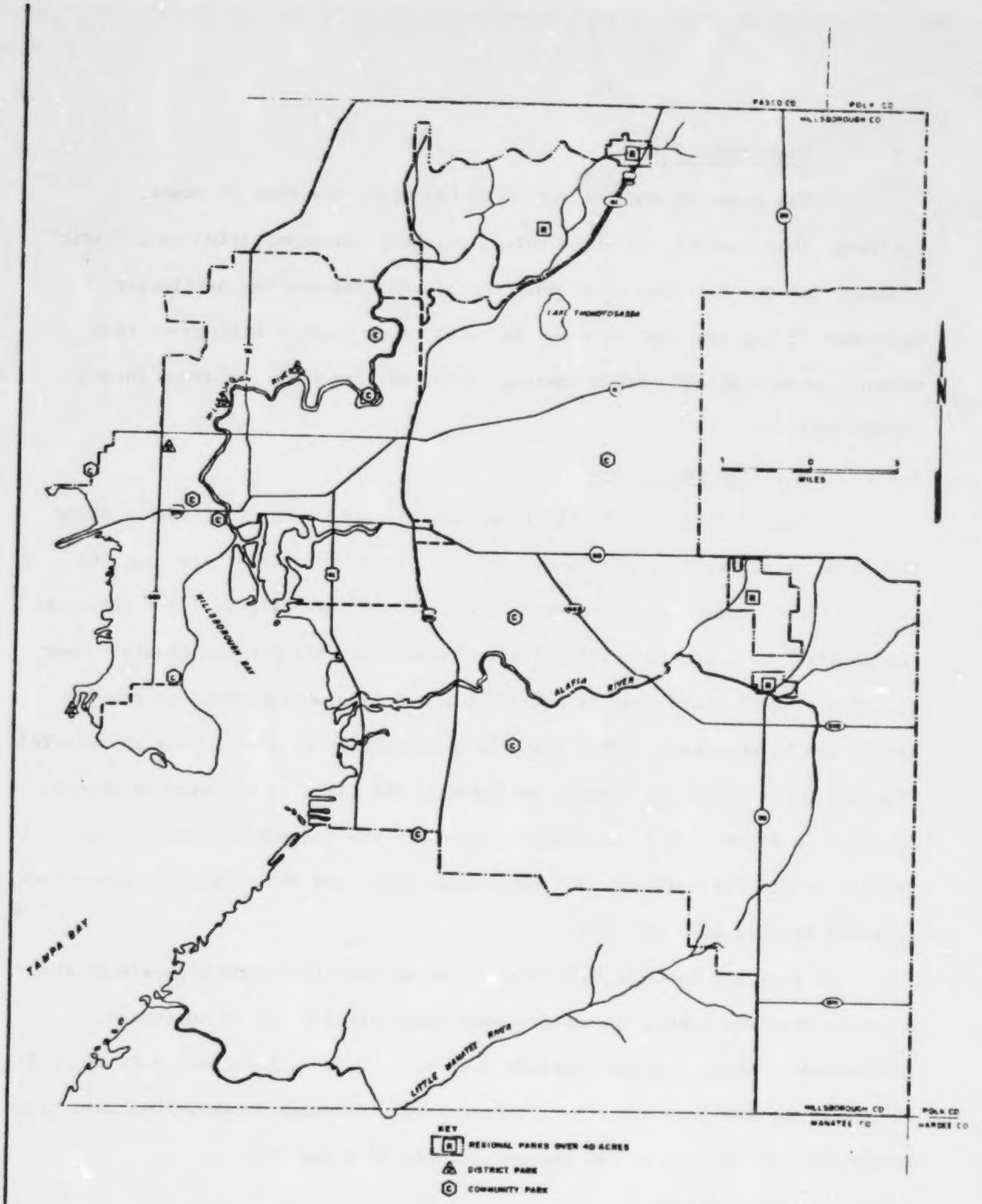
DAMES & MOORE

FIGURE I.7-1

The largest park in the Planning Area is the Hillsborough River State Park. Classified as a park generating regional interest, it consists of 2,964 acres with over 100 spaces available for tent or trailer camping. The park is classified as a developed resource by the Department of Natural Resources and offers picnicking, swimming, fishing, boating and nature trails. For fiscal year 1975-77 the park's cumulative attendance by overnight and day visitors was 276,450 persons.

Other regional parks are located south of Plant City in the vicinity of Durant, Hopewell and Pinecrest. Parks including the smaller urban and neighborhood parks are shown in Figure I.7-2.

In addition to the public recreational areas, there are the many private areas used for hunting and fishing as well as golf. Tampa Bay is also a source of sport fishing, including the annual Tarpon Tournament of Tampa.


PASCO CO
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LAKE THONOTOSASSA
HILLSBOROUGH RIVER
HILLSBOROUGH BAY
ALAFIA RIVER
TAMPA BAY
LITTLE MANATEE RIVER
N
MILES
HILLSBOROUGH CO
POLK CO
MANATEE CO
HARDEE CO
KEY
R REGIONAL PARKS OVER 40 ACRES
DISTRICT PARK
C COMMUNITY PARK

DATA SOURCES

1 OUTDOOR RECREATION IN FLORIDA, 1976 STATE OF FLORIDA, DEPT OF NATURAL RESOURCES DIVISION OF STATE PARKS AND RECREATION

2 ST PETERSBURG HEALTH DEPARMENT

3 FLORIDA DEPT TRANSPORTATION AREAS OF ENVIRONMENTAL CONCERN MAPS FOR PASCO, PINELLAS, HILLSBOROUGH, AND MANATEE COUNTIES

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PLANNING AREA PARKS AND RECREATION AREAS

DAMES & MOORE

FIGURE I.7-2

I.8 TRANSPORTATION

The planning Area is served by highways, the Port of Tampa, railroads, bus service and air service. Although transportation is a "basic" industry for the Planning Area, only the highway network has particular relevance to the proposed action. An existing or planned highway or road network, when combined with a sewerage plan, may strongly influence future growth patterns.

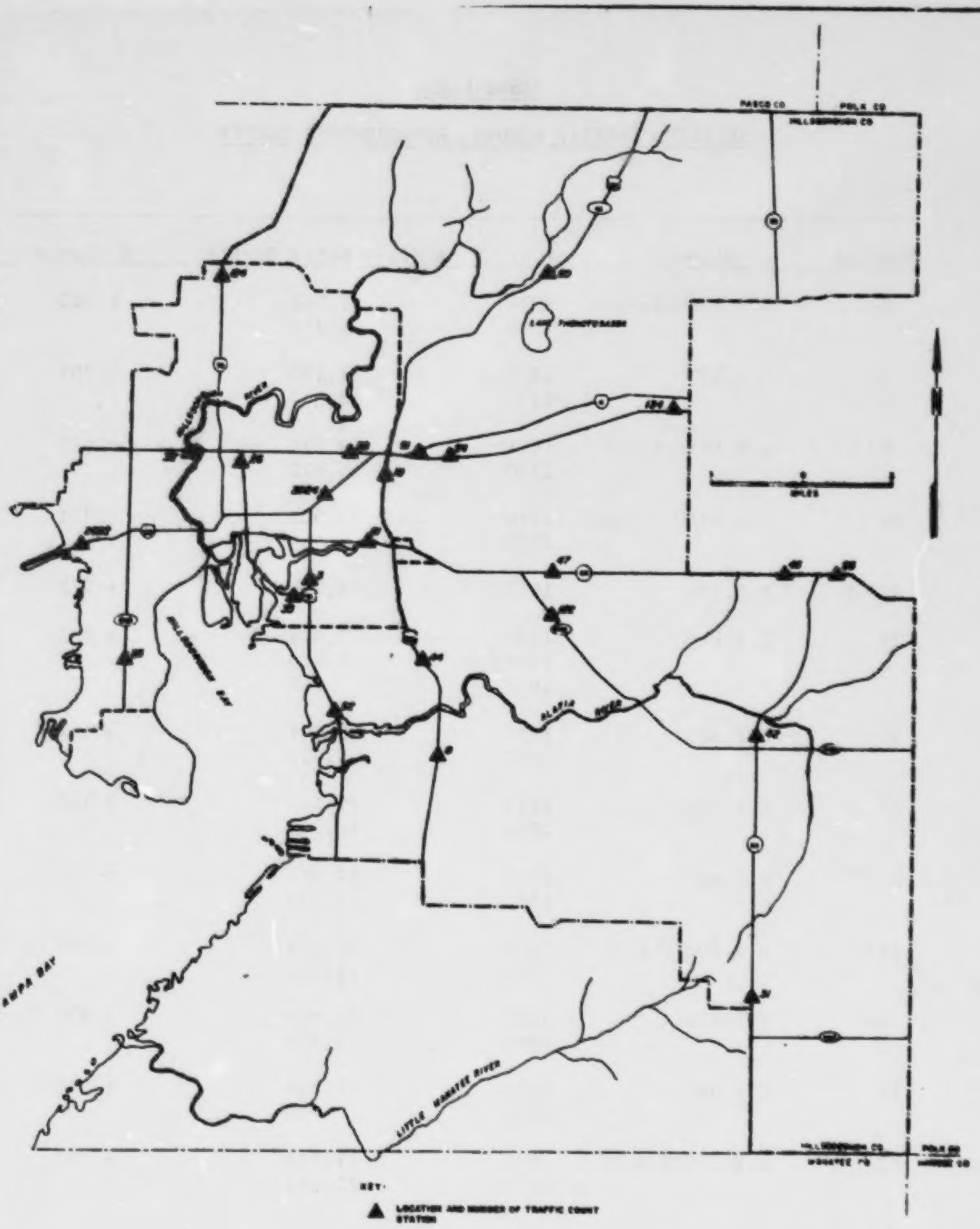
I.8.1 Existing Conditions

Travel levels in Hillsborough County have risen dramatically since 1970. Major highways in the Tampa vicinity at present (1977) are carrying traffic flows as much as 200 percent above 1970 flows. Figure I.8-1 indicates the location of selected traffic count stations in Hillsborough County. Many of these stations have been in operation since 1970 so increases in traffic levels may be analyzed. Table I.8-1 is a summary of traffic levels at selected stations in Hillsborough County; included in the table is the station number, as found on Figure I.8-1, the highway on which the station is located, the traffic levels for 1970 and 1977 (approximately), and the calculated percentage increase between 1970 and 1977.

From the Horizon 2000 Plan it can be seen that many highways in the Planning Area are likely to receive additional traffic due to increased development. These highways include U.S. 41, U.S. 301, S.R. 640, S.R. 60, S.R. 574, S.R. 600 and Interstate 4. Traffic level increases on these highways have ranged from 40 percent to 180 percent between 1970 and 1977.

I.8.2 Future Trends

According to the proposed highway plan outline in the Hillsborough County Horizon 2000 document, traffic conditions in the Planning Area including


PASCO CO
POLK CO
HILLSBOROUGH CO
LAKE THONOTOSASSA
HILLSBOROUGH RIVER
HILLSBOROUGH BAY
ALAFIA RIVER
TAMPA BAY
LITTLE MANATEE RIVER
MILES
N
HILLSBOROUGH CO
POLK CO
MANATEE CO
HARDEE CO
KEY:
LOCATION AND NUMBER OF TRAFFIC COUNT STATION

SOURCE : FLORIDA DEPARTMENT OF TRANSPORTATION, 1976

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SELECTED TRAFFIC COUNT STATIONS

FIGURE I.8-1

TABLE I.8-1

SELECTED TRAFFIC COUNTS, HILLSBOROUGH COUNTY

Station	Highway	Year	Average Daily Traffic	% Change
1*	S.R.45/U.S.41	1977	12,342	+ 32%
		1970	9,357	
3	S.R.583	1977	31,153	+ 70%
		1970	18,547	
8*	S.R.43/U.S.301	1977	9,629	+ 42%
		1970	5,622	
10	S.R.43/U.S.301	1976	23,502	+180%
		1970	8,404	
11* E	S.R.574	1977	5,744	+ 47%
23	S.R.674	1970	3,911	+ 43%
		1977	1,215	
		1970	848	
25	S.R.685	1977	28,541	+ 12%
		1970	25,432	
26	S.R.585	1977	11,655	+ 14%
		1970	10,249	
27*	S.R.60	1977	17,281	+ 46%
		1970	11,829	
28*	S.R.600/U.S.92	1977	15,524	+ 38%
		1970	11,256	
30*	S.R.676	1977	11,359	+ 92%
		1970	5,905	
31	S.R.39	1975	1,330	+ 76%
		1970	756	
32	S.R.600/U.S.92	1977	23,231	+ 9%
		1970	21,241	

TABLE I.8-1 (Cont.)

Station	Highway	Year	Average Daily Traffic	% Change
33*	S.R.45/S.R.41	1977	16,580	+ 41%
		1970	11,759	
35	S.R.574	1977	13,062	+ 54%
		1970	8,465	
38	S.R.600/U.S.92	1977	24,499	+ 53%
		1970	16,024	
41	S.R.39	1977	7,078	+ 60%
		1970	4,418	
42	S.R.39	1975	3,550	+ 99%
		1970	1,782	
44*	S.R.43/U.S.301	1977	12,308	+ 69%
		1970	7,301	
46	S.R.60	1977	14,724	+ 55%
		1970	9,510	
47*	S.R.60	1977	29,959	+ 48%
		1970	20,267	
50*	S.R.41/U.S.301	1977	4,129	+ 44%
		1970	2,862	
51	S.R.41/U.S.301	1977	17,363	+ 54%
		1970	11,285	
52	S.R.41/U.S.301	1976	26,110	+ 93%
		1970	13,518	
54	S.R.600/U.S.92	1977	8,062	+ 73%
		1970	4,649	
55	S.R.60	1977	13,572	+ 51%
		1970	8,969	
61* E	S.R.60	1977	38,806	+ 45%
		1971	26,814	
91*	S.R.400/14	1977	40,231	+122%
		1970	18,156	

TABLE I.8-1 (Cont.)

Station	Highway	Year	Average Daily Traffic	% Change
92	S.R.580	1977	13,311	+165%
		1970	5,009	
94	S.R.581	1975	11,942	+216%
		1970	3,774	
95	S.R.589	1975	34,218	+103%
		1970	16,875	
101	S.R.583	1977	8,928	+110%
		1970	4,250	
108	S.R.508	1977	16,445	+ 39%
		1970	11,819	
114	S.R.574A	1977	9,582	+ 75%
		1970	5,465	
115	S.R.574	1977	7,180	+ 8%
		1970	6,655	
118	S.R.582	1977	12,701	+263%
		1970	3,495	
122	S.R.640	1977	8,980	+ 88%
		1970	4,777	
124	S.R.45/U.S.41	1977	15,304	+ 75%
		1970	8,754	
136	S.R.582A	1977	3,823	+103%
		1973	1,887	
2022* E	S.R.400/14	1977	56,704	+ 74%
		1970	32,607	
2024	S.R.400/14	1977	40,237	+ 51%
		1970	26,645	

Source: Florida Department of Transportation, Bureau of Planning

* Bus Route
E = Express Route

the Tampa urban area, will be considerably more congested than 1977 conditions. The recommended highway system will provide, under average daily traffic conditions, a level of service rating of "D". This level of service approaches unstable flow with minimum operating speeds being maintained. Under peak hour conditions, the proposed system will operate at service level E, one grade lower than D. Under these conditions, traffic flows are unstable and at times may halt completely. This level of service is associated with operation of facilities at capacity flows. To provide some comparison of service levels, Table I.8-2 defines conditions inherent at level of service A through F.

The recommended highway network (Figure I.8-2) is considered by the county a minimal system for the year 2000. The minimal approach was chosen based on the lack of funds available for a larger capacity system. However, the proposed system has 274 land-miles of new freeways and 583 land-miles of new collectors and arterials compared to the existing network of 131 miles of freeway and 1,305 miles of collectors and arterials. The system is slated for expansion but the improvements may not be extensive enough to maintain existing service levels for the projected service demands.

Possibly, the increased demand on the transportation system can be met by the projected mass transit system, an all bus alternative designed to give greater service to transient dependent riders and attract new riders. The system is designed to carry approximately 76,300 persons per day. Figure I.8-3 indicates the proposed bus transit plan.

I.8.3 Summary

The location and sizing of interceptors will influence the demand for new roads. The Horizon 2000 Plan indicates possible traffic development in which land use and development plans have been considered. Deviations from the plan may result in increased highway costs.

TABLE I.8-2

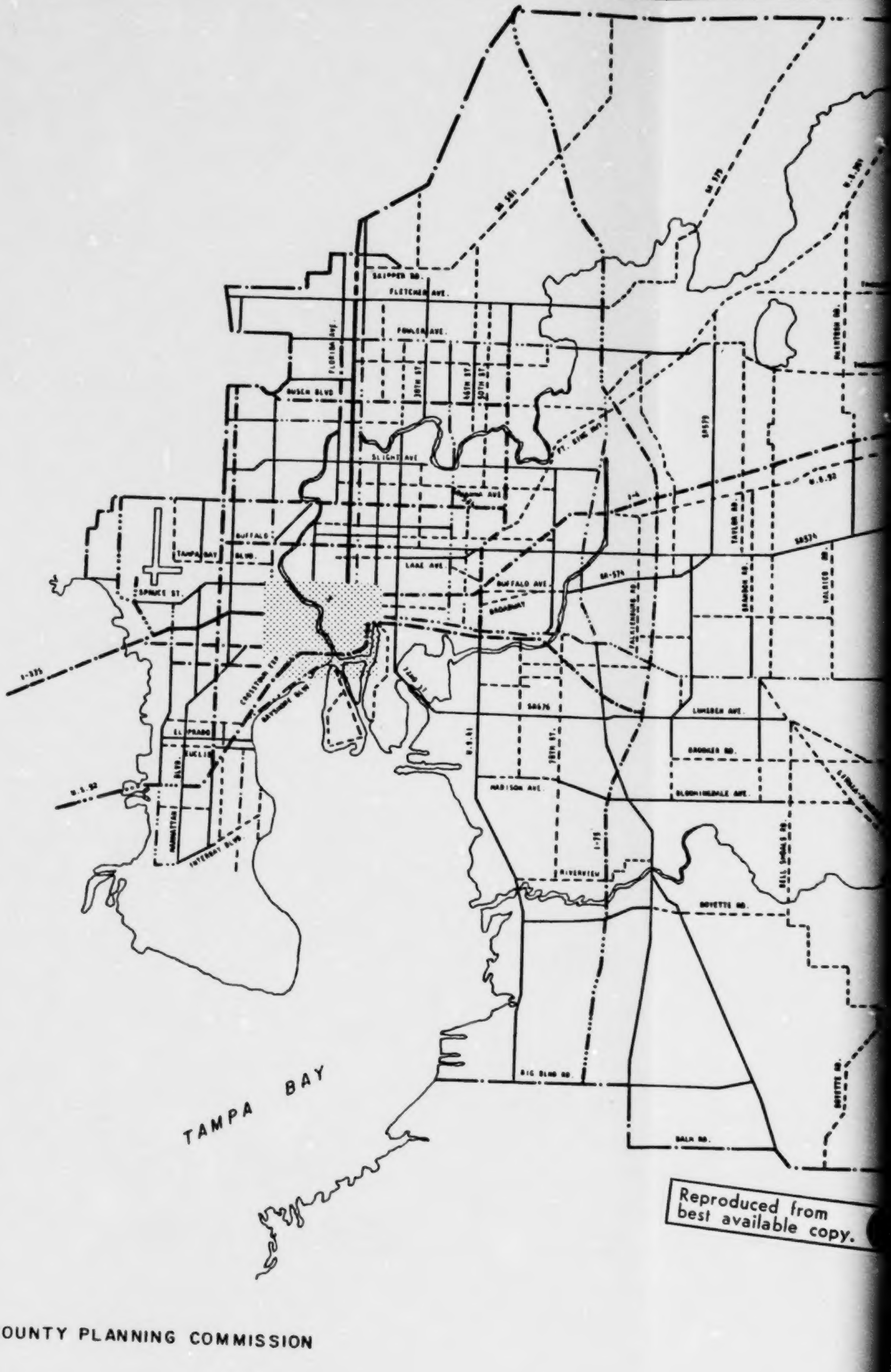
LEVEL OF SERVICE DEFINITIONS

TITLE	DESCRIPTION
Level of Service A:	This is a condition of free flow, accompanied by low volumes and high speeds. Traffic density will be low, with uninterrupted flow speeds controlled by driver desires, speed limits and physical roadway conditions. There is little or no restriction of maneuverability due to the presence of other vehicles, and drivers can maintain their desired speeds with little or no delay.
Level of Service B:	This occurs in the zone of stable flow, with operating speeds beginning to be restricted somewhat by traffic conditions. Drivers still have reasonable freedom to select their speed and lane of operation. Reductions in speed are not unreasonable, with a low probability of traffic flow being restricted. The lower limit (lowest speed, highest volume) of this level of service has been used in the design of rural highways.
Level of Service C:	This is still in the zone of stable flow, but speeds and maneuverability are more closely controlled by the higher volumes. Most of the drivers are restricted in their freedom to select their own speed, change lanes, or pass. A relatively satisfactory operating speed is still obtained, with service volumes suitable for urban design practice.
Level of Service D:	This level of service approaches unstable flow, with tolerable operating speeds being maintained, though considerably affected by changes in operating conditions. Fluctuations in volume and temporary restrictions to flow may cause substantial drops in operating speeds. Drivers have little freedom to maneuver, and comfort and convenience are low. These conditions can be tolerated, however, for short periods of time.

TABLE I .8-2 (Cont.)

TITLE	DESCRIPTION
Level of Service E:	This cannot be described by speed alone, but represents operations at lower operating speeds, typically, but not always, in the neighborhood of 30 miles per hour, with volumes at or near the capacity of the highway. Flow is unstable, and there may be stoppages in momentary duration. This level of service is associated with operation of a facility at capacity flows.
Level of Service F:	This describes a forced-flow operation at low speeds, where volumes are below capacity. In the extreme, both speed and volume can drop to zero. These conditions usually result from queues of vehicles backing up from a restriction downstream. The section under study will be serving as a storage area during parts or all of the peak hour. Speeds are reduced substantially and stoppages may occur for short or long periods of time because of the downstream congestion.

Source: Pignataro, Louis J., 1973. Traffic engineering: theory and practice.


SKIPPER RD.
FLETCHER AVE.
FOWLER AVE.
FLORIDA AVE.
BUSCH BLVD.
30TH ST.
46TH ST.
50TH ST.
SR 581
SR 579
U.S. 301
MCINTOSH RD.
FT. KING HWY
SLIGH AVE.
SR 579
I-4
U.S. 92
TAYLOR RD.
SR 574
BUFFALO
TAMPA BAY BLVD.
LAKE AVE.
BUFFALO AVE.
SR-574
BROADWAY
FALKENBURG RD.
BRANDON RD.
VALRICO RD.
SPRUCE ST.
I-275
CROSSTOWN EXP.
BAYSHORE BLVD.
22ND ST.
SR 676
LUMSDEN AVE.
EL PRADO
EUCLID
U.S. 92
MANHATTAN BLVD.
U.S. 41
78TH ST.
GRONGER RD.
MADISON AVE.
BLOOMINGDALE AVE.
INTERBAY BLVD.
I-75
RIVERVIEW
BELL SHOALS RD.
BOYETTE RD.
BIG BEND RD.
BOYETTE RD.
BALM RD.
TAMPA BAY

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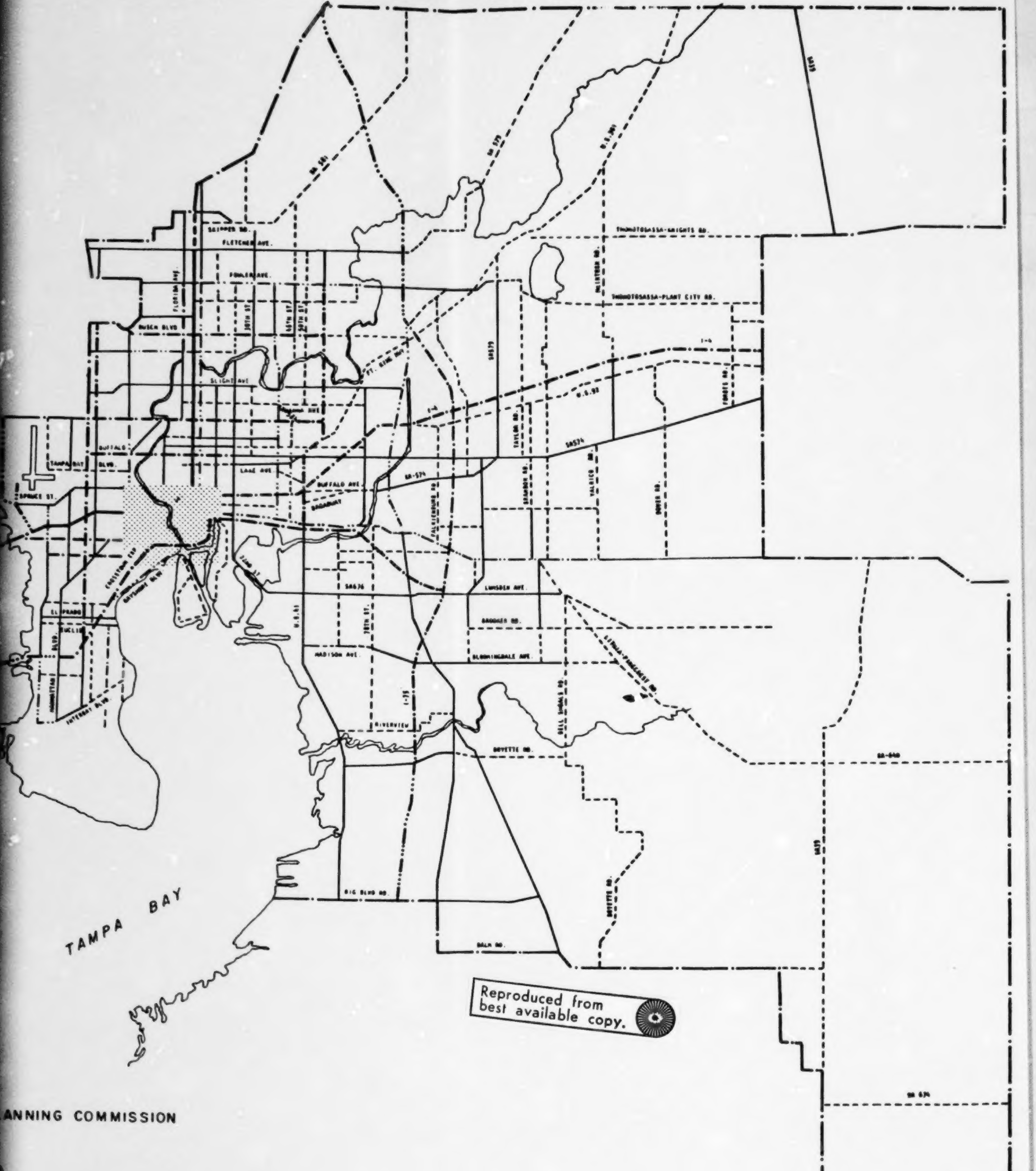
SKIPPER RD.
FLETCHER AVE.
FOWLER AVE.
FLORIDA AVE.
BUSCH BLVD.
30TH ST.
40TH ST.
SR 581
SR 579
U.S. 301
THONOTOSASSA-KNIGHTS RD.
McINTOSH RD.
THONOTOSASSA-PLANT CITY RD.
FT. KING HWY
SLIGH AVE
I-4
U.S. 92
SR 579
TAYLOR RD.
SR 574
FORBES RD.
BUFFALO
TAMPA BAY BLVD.
LAKE AVE.
BUFFALO AVE.
SPRUCE ST.
BROADWAY
SR-574
FALKENBURG RD.
BRANDON RD.
VALRICO RD.
DOVER RD.
CROSSTOWN EXP.
BAYSHORE BLVD.
22ND ST.
SR 676
LUMSDEN AVE.
EL PRADO
EUCLID
U.S. 41
78TH ST.
BROOKER RD.
MANHATTAN
BLVD.
MADISON AVE.
BLOOMINGDALE AVE.
LITHIA-PINECREST RD.
I-75
BELL SHOALS RD.
INTERBAY BLVD.
RIVERVIEW
BOYETTE RD.
SR 640
SR 39
BOYETTE RD.
BIG BEND RD.
BALM RD.
SR 674
TAMPA BAY

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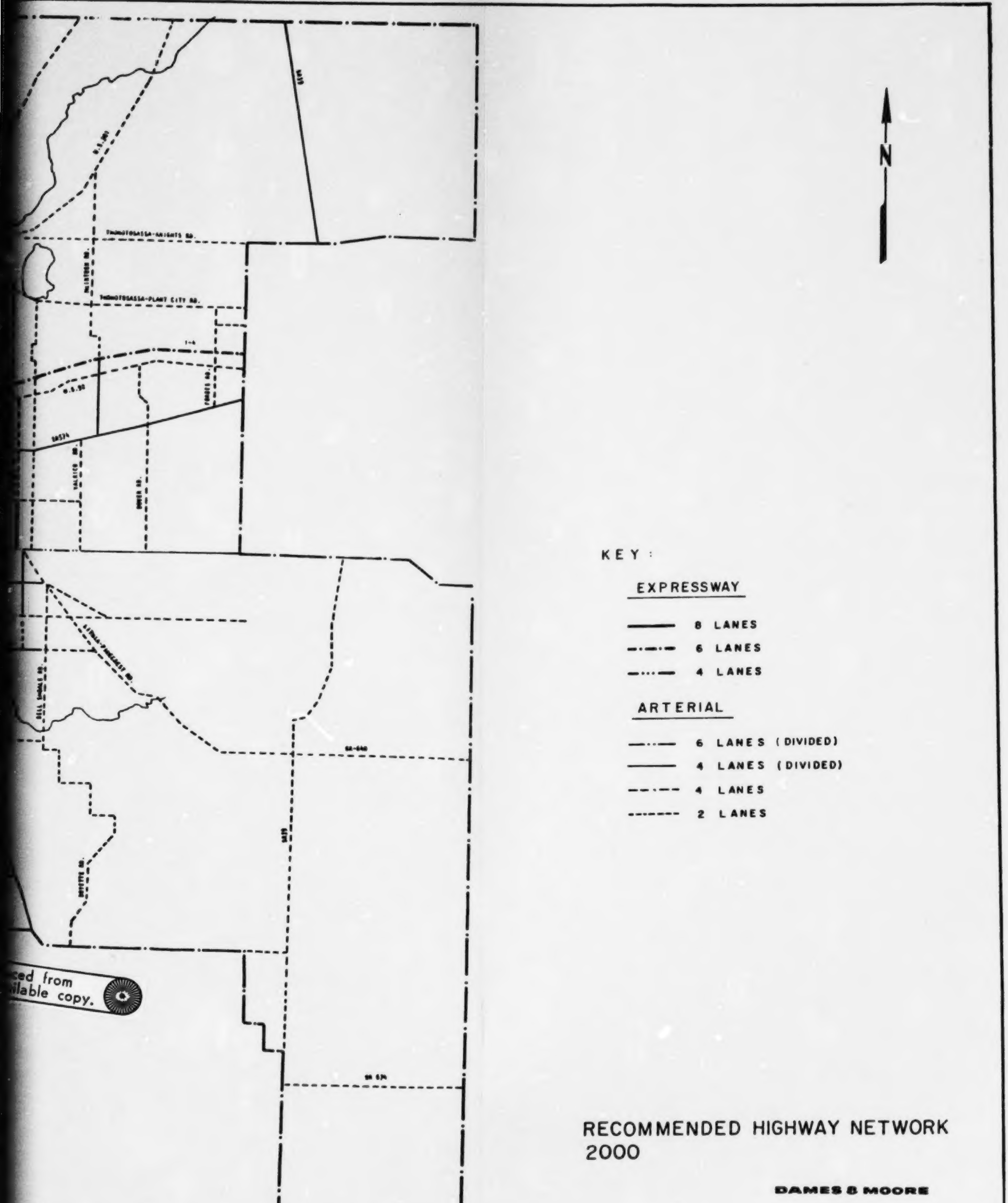
THONOTOSASSA-KNIGHTS RD.
THONOTOSASSA-PLANT CITY RD.
MCINTOSH RD.
U.S.301
SR39
I-4
U.S.92
FORBES RD.
SR574
VALRICO RD.
DOVER RD.
LITHIA-PINECREST RD.
BELL SHOALS RD.
SR-640
SR39
BOYETTE RD.
SR 674
N
KEY:
EXPRESSWAY
8 LANES
6 LANES
4 LANES
ARTERIAL
6 LANES (DIVIDED)
4 LANES (DIVIDED)
4 LANES
2 LANES

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RECOMMENDED HIGHWAY NETWORK
2000

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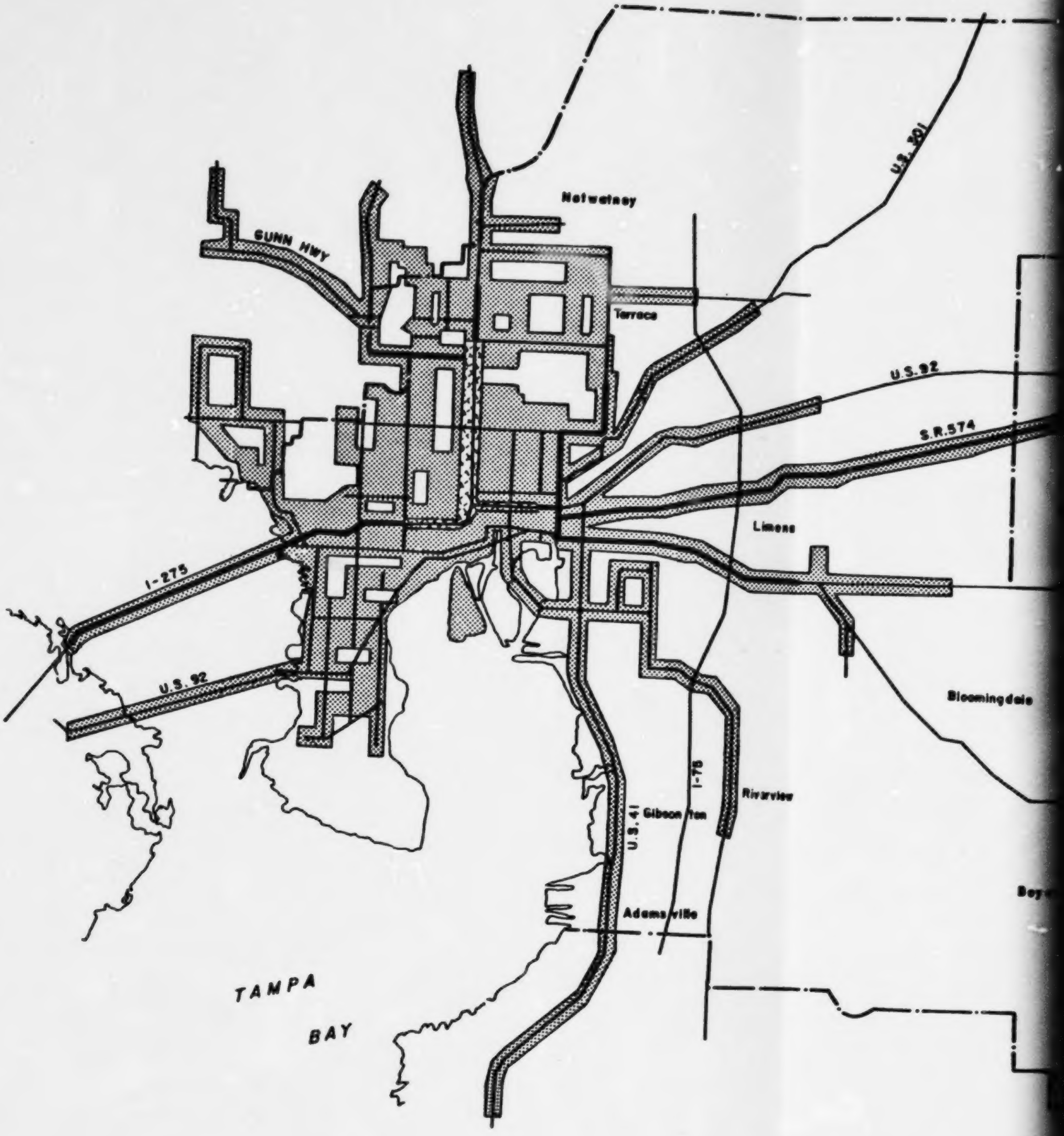
FIGURE I.8-2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GUNN HWY
Terrace
U.S. 92
S.R. 574
Limona
I-275
U.S. 92
Bloomingdale
I-75
U.S. 41
Gibsonton
Riverview
Adamsville
Boy
TAMPA
BAY

SOURCE : HILLSBOROUGH COUNTY PLANNING COMMISSION

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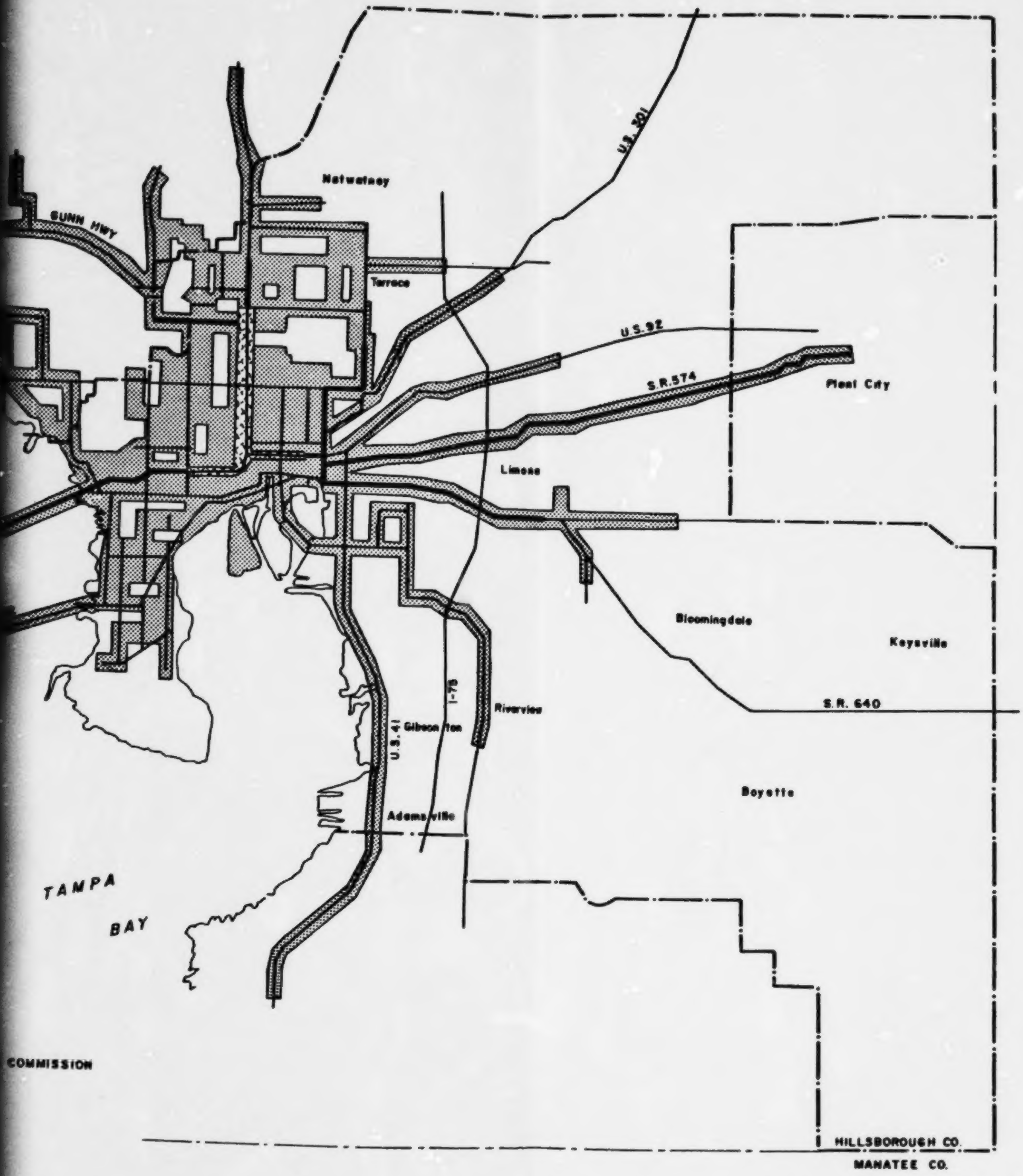

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Keysville
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Riverview
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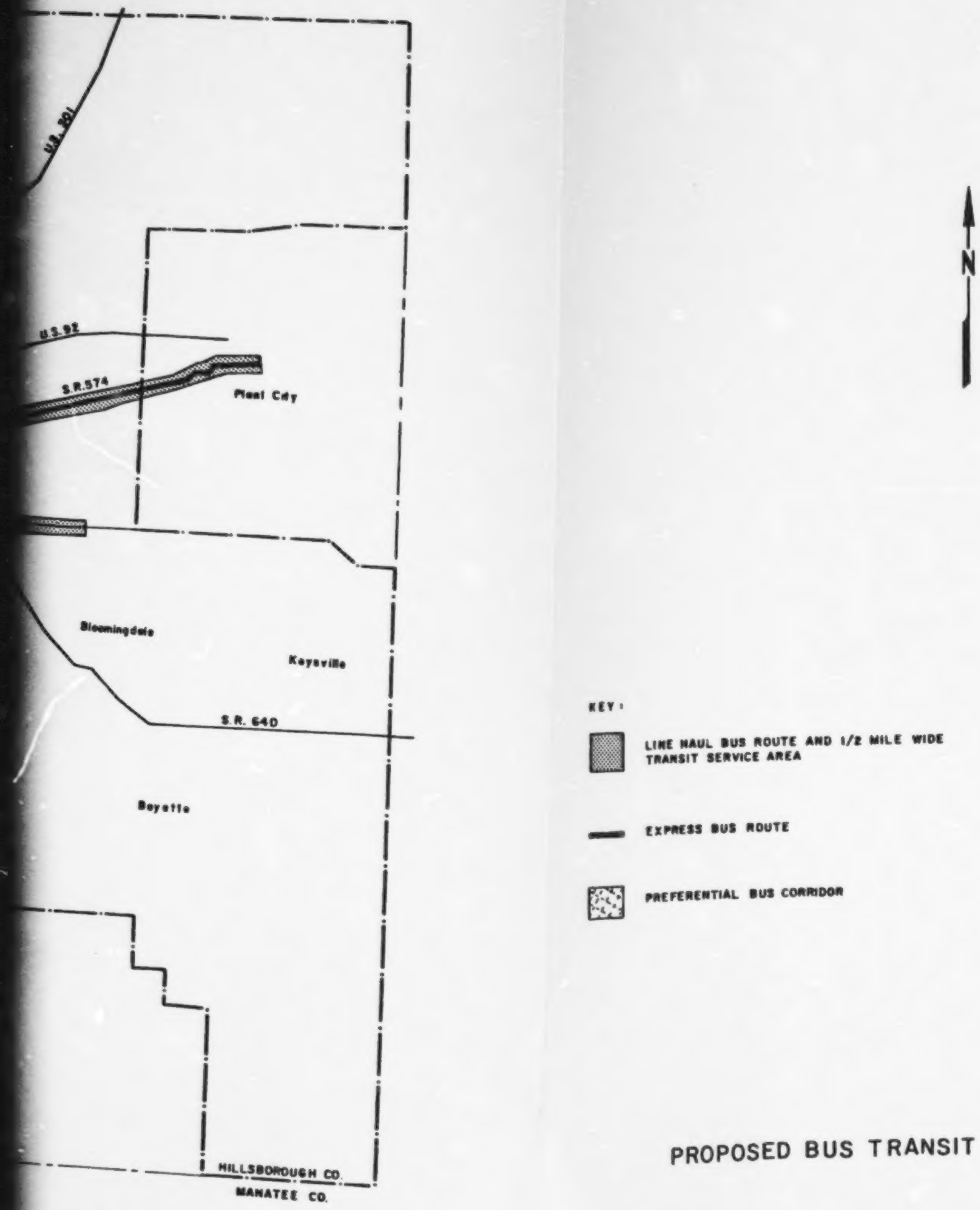
Gibsonton
Boyette
Adamsville
TAMPA
BAY
COMMISSION
HILLSBOROUGH CO.
MANATEE CO.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S.R.574
Plant City
Bloomingdale
Keysville
S.R. 640
Boyette
HILLSBOROUGH CO.
MANATEE CO.
N
KEY:
▨ LINE HAUL BUS ROUTE AND 1/2 MILE WIDE TRANSIT SERVICE AREA
▬ EXPRESS BUS ROUTE
▧ PREFERENTIAL BUS CORRIDOR

PROPOSED BUS TRANSIT PLAN

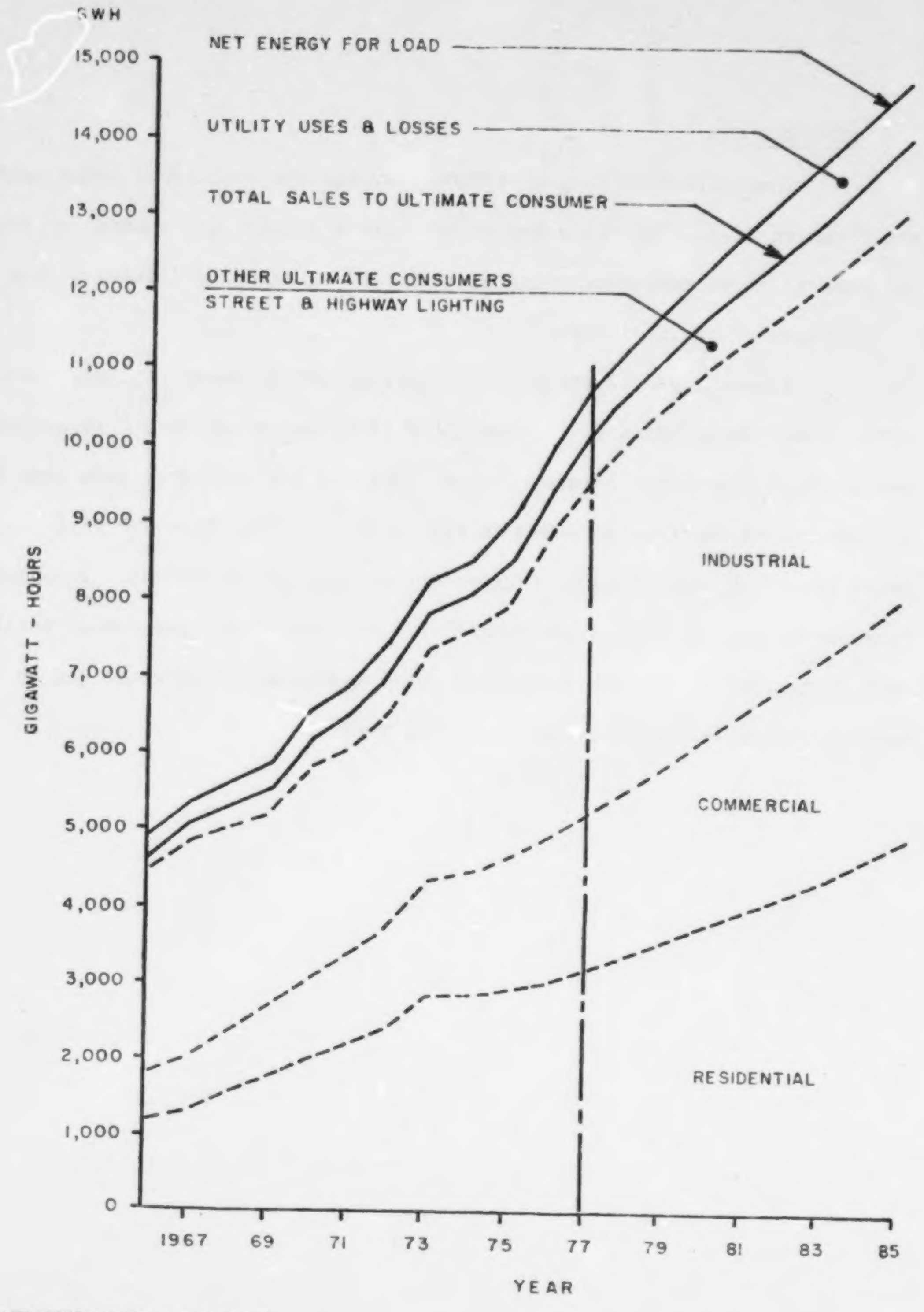
DAMES & MOORE

FIGURE I.8-3

I.9 RESOURCE USE

Tampa Electric Company (TECO) provides the electrical power used in the Planning Area. TECO is governed by various regulations imposed by state and federal government concerning expansion of existing facilities or the construction of new facilities.

Figure I.9-1 illustrates the history and forecast of energy use for TECO. Power consumption by the residents of Hillsborough County is steadily increasing. The margin between present capacity and projected peak load demand is expected to decrease as shown in Figure I.9-2. This increase will necessitate the construction of new power generation facilities. In order to conserve energy and reduce the demand for increased power generating facilities TECO participates in citizen oriented power conservation programs and is actively investigating alternative energy sources.



SOURCE - HILLSBOROUGH COUNTY PLANNING COMMISSION, 1978

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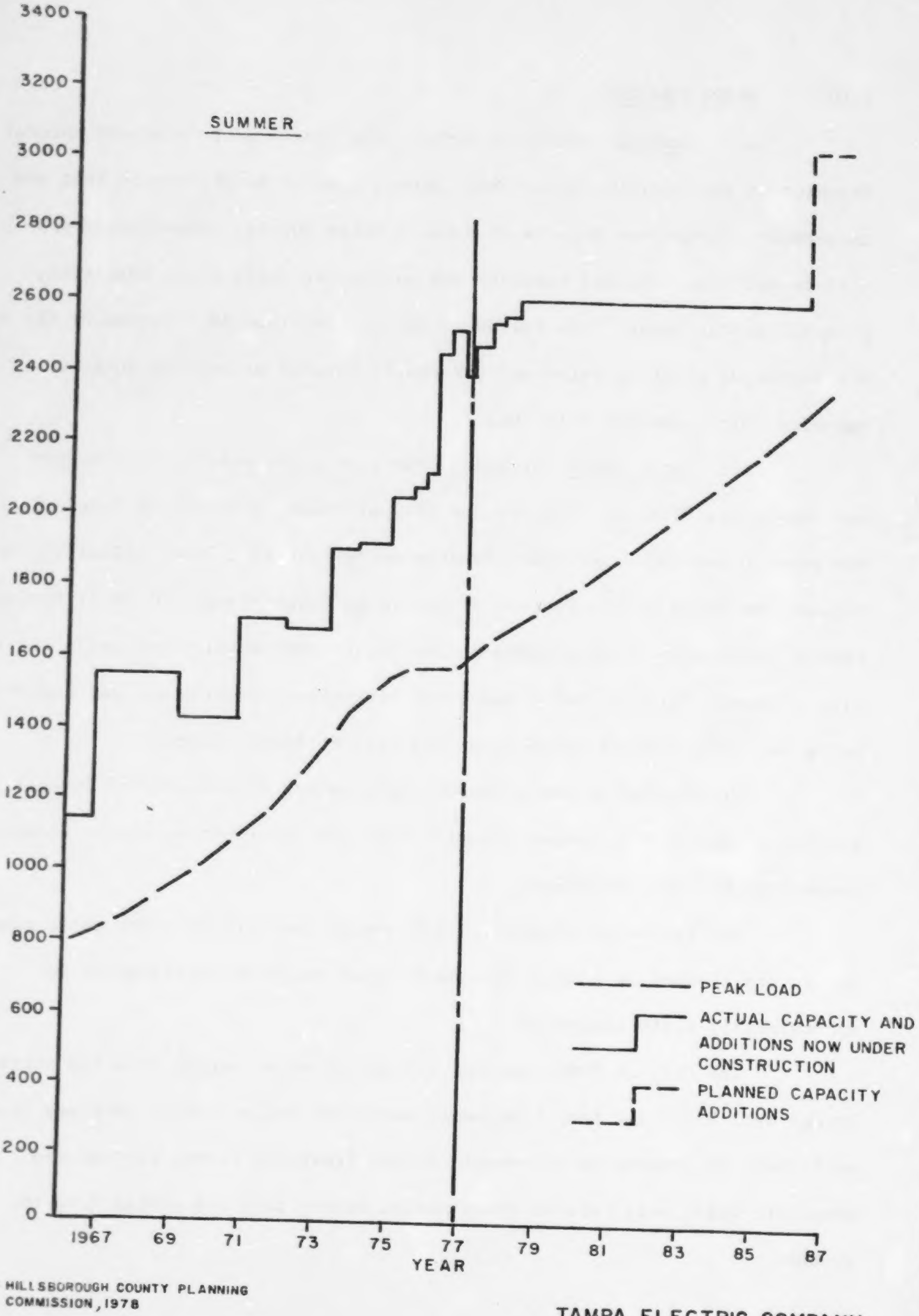
TAMPA ELECTRIC COMPANY
HISTORY AND FORECAST OF ENERGY USE

DAMES & MOORE
FIGURE I.9-1



SOURCE: HILLSBOROUGH COUNTY PLANNING COMMISSION, 1978

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CENTRAL HILLSBOROUGH COUNTY - TAMPA
201 FACILITY PLAN
ENVIRONMENTAL REPORT
EPA No C120634010

**TAMPA ELECTRIC COMPANY
HISTORY AND FORECAST OF LOAD
AND CAPACITY ADDITIONS**

DAMES & MOORE
FIGURE I.9-2

I.10 WATER PROGRAMS

a. General: Water is perhaps the single most important natural resource in the Planning Area. Many agencies exist in the region that are concerned with various aspects of potable water supply, ground water and surface water quality and quantity and wastewater collection, treatment, disposal and/or reuse. The following section provides an overview of the type and extent of existing water and wastewater systems as well as water law agencies which regulate water use.

b. Water Supply Systems: The four major public water supply systems in the Planning Area are the City of Tampa, the City of Temple Terrace, the Brandon and the Riverview-Gibsonton water systems. Descriptions of these systems are found in the Central Hillsborough County-Tampa 201 Facility Plan report. Basically these systems derive their water supply from wells for the City of Temple Terrace, the Brandon and Riverview-Gibsonton systems and from wells and surface water sources for the City of Tampa system.

The Brandon system provides chlorination at each of the 26 well locations and water is pumped directly into the distribution system serving approximately 9,500 customers.

The Riverview-Gibsonton water system consists of eight wells whose waters are treated by a water treatment plant prior to distribution to approximately 4,310 customers.

The City of Tampa derives its ground water supply from the Morris Bridge Well Field and from five small satellite wells. Water obtained from the well field is treated at the Morris Bridge Treatment Plant, whereas the satellite wells only receive chlorination before they are pumped into the system.

The major surface water supplies for the City of Tampa are from the Hillsborough River and Sulphur Springs. These waters are treated at the Hillsborough River Treatment Plant which primarily uses floculation and sedimentation followed by sand filtration and chlorination before being pumped into the distribution system.

The combined surface and ground water system for the City of Tampa currently serves about 125,000 people.

The Temple Terrace water supply is provided by seven wells. The waters from three of these wells are aerated and chlorinated and the waters from the other four wells are chlorinated at the well sites. A water treatment plant is currently being constructed and is expected to be on line by 1981 (Fernandez, Bob, 1979, personal communication).

There are several private water systems in the Planning Area which depend primarily upon ground water for their source of water. There are over 7,000 wells permitted by the Southwest Florida Water Management District (SWFWMD) in the Planning Area, the majority of which are used for domestic purposes. Section 4.1.2 of the 201 Facilities Plan Report describes in greater detail the number and uses of wells in the Planning Area. Treatment of water from these wells varies depending on the intended use of the water. In-line chlorination, filtering and water softening are common procedures depending on the local ground water quality.

c. Wastewater Systems: The Planning Area is served by septic systems, package plants, Hillsborough County's Brandon Sewer System and the City of Tampa's Sanitary Sewerage System.

Rural areas and subdivisions primarily utilize septic tanks with drain fields. Within the County Service Area, there are 80 package wastewater treatment plants serving many commercial establishments, apartment complexes, schools and some subdivisions. The total design capacity of these facilities is approximately 2.3 mgd.

Hillsborough County's Brandon Sewer System includes 46 county owned pumping stations and several private pumping stations, force mains and gravity collection systems which serve portions of the residential and commercial needs of the Brandon area. The average flow of the Brandon Sewer System is estimated at 1.05 mgd. The flows from the Brandon Sewer System are pumped to the City of Tampa Sewer System through a 16-inch force main for treatment at the Hooker's Point Wastewater Treatment Plant.

Approximately 60 percent of the entire Tampa Service Area is served by sanitary sewers. The vast majority of wastewater collection facilities are owned and operated by the City of Tampa with the remaining facilities being owned and operated by Hillsborough County or by private franchises. The existing wastewater collection system within the Tampa Service Area is shown on Figure I.11-2. The sanitary wastewater collection system is separate from the storm water collection system.

There are apparently no records available of the development of the wastewater system in the City of Tampa prior to 1925. From that time, however, gradual expansion of the system progressed until 1947 under municipal and Federal Works Progress Administration projects. Beginning in 1948 rapid and significant expansion of the collection system commenced under the First Sewer Revenue Bond Program. As the City of Tampa grew and expanded, the wastewater collection system was also expanded under the Second and Third Sewer Revenue Bond Programs (1954 and 1962, respectively).

In 1969, the City of Tampa commenced planning for the Fourth Sewer Revenue Bond Program. With the advent of Public Laws 660 and 92-500, however, the concept of a revenue bond program was discarded in favor of a program involving Federal participation in the form of financial grants-in-aid. The title of the program was consequently changed to the Fourth Wastewater Improvement Program. The ongoing Fourth Wastewater Improvement Program comprises the construction of a new 60-mgd advanced wastewater treatment plant at Hookers Point and approximately 190 miles of new intercepting, secondary intercepting and neighborhood sewers and force mains and 27 pumping stations. The Hookers Point Advanced Wastewater Treatment Plant has been completed and placed in service and approximately 27 miles of intercepting sewers and force mains with four major pumping stations are currently in various stages of construction, or about to be constructed, all with the assistance of Federal financial grants. Approximately 19 miles of neighborhood sewers and force mains with three small pumping stations have also been constructed under the Fourth Wastewater Improvement Program.

Although the wastewater collection system in the Tampa Service Area has been steadily expanded to attempt to meet the ever increasing demand for sanitary sewer service, a significant percentage of the Tampa Service Area remains unsewered (40 percent) and residents and commercial establishments located beyond the limits of the collection system must rely on individual disposal systems.

The Tampa Service Area has been divided into four study areas containing 45 sewer districts. Sewer district boundaries were selected on the basis of several factors such as the physical arrangement of existing collection systems, topography, land use and political boundaries. The districts range in size from 54 acres (Dist. 6) to 9,282 acres (Dist. 1).

Wastewater generated in the individual sewer districts is conveyed through a series of progressively larger pipelines terminating at treatment and disposal facilities. Neighborhood collection sewers located throughout each of the districts serve residences, commercial businesses and industries and convey wastewater to larger secondary interceptors or pumping stations. Owing to the limited topographic relief in the Tampa Service Area, a large number of pumping stations are required to transmit wastewater to other segments of the gravity system or directly to a treatment plant. Secondary intercepting sewers, which carry flow from one or more districts, discharge wastewater into large intercepting pipelines which lead directly to the treatment plant. For further discussion of the wastewater facilities of the Planning Area the reader is referred to the 201 Facility Plan.

d. State Agencies and Regulations Addressing Water Quality and Water Quantity: The Florida Constitution (Art. II, Sec. 7) states that "It shall be the policy of the state to conserve and protect its natural resources and scenic beauty. Adequate provisions shall be made by law for the abatement of air and water pollution ...." To this end, the state legislature has passed laws which enable state agencies to regulate and control water and air pollution as well as land use in the Planning Area. The most significant pieces of legislation, with regard to sewage collection, treatment and disposal, are discussed below.

The Florida Air and Water Pollution Control Act (Chap. 403, F.S.) controls wastes discharge into waters of the state and gives the Department of Environmental Regulation (DER) the powers necessary to administer a permitting program for stationary installations which can reasonably be expected to be a source of air or water pollution. These permits are not issued if the discharge of waste will lower water quality below established levels (Chap. 17-3, F.A.C.).

Chapter 403 should be considered with four landmark bills passed during the 1972 legislative session: The Environmental Land and Water Management Act, The Land Conservation Act, The Water Resources Act, and The Florida State Comprehensive Planning Act. Together these interrelated laws form a systematic mosaic of legislative and administrative strategies that comprise Florida's land and water use policies (Starnes, 1974).

Although local governments continue to be responsible for land use decisions of strictly local impact, the above legislation has fixed the role of the state in controlling decisions of regional importance.

For example, the Environmental Land and Water Management Act established the method of designating "areas of critical state concern" (Chap. 380, F.S.). Basically, an area can be so designated if it: (1) contains or has significant impact upon environmental, historical, natural or archaeological resources of regional or statewide importance; or (2) be significantly affected by, or have a significant effect upon, an existing or proposed major public facility or other area of major public investment; or (3) be of major development potential as defined in the State Land Development Plan.

In addition, Chapter 380 empowers the state to determine whether a particular land development project constitutes a "development of regional impact" (DRI). To be so designated, a proposed use must be of such character or magnitude that it affects more than one county. The applicant must then prepare a DRI report which contains sufficient information for planning agency review. After a public hearing, this agency submits its recommendations to local government.

The Water Resources Act of 1972 provides for regulation of inland and coastal waters of the state by the Water and Management Districts. In the

Planning Area, the Southwest Florida Water Management District (SWFWMD) has the responsibility for regulating conservation, development and proper utilization of surface and ground waters. SWFWMD is required to prevent damage from flooding, soil erosion and excessive drainage as well as to protect natural resources, fish and wildlife.

Under the Comprehensive Planning Act of 1972, the Division of State Planning was required to develop a comprehensive plan consisting of goals, objectives and policies to guide the orderly social and economic growth of the state. As required by the act, the Hillsborough County Planning Commission developed the Horizon 2000 Plan.

The Land Conservation Act, passed by statewide referendum in 1972 provided funds for the state to acquire environmentally endangered lands and to acquire and improve recreation facilities. These programs have been administered by the Department of Natural Resources (DNR).

According to Starnes (1974) the strategy which led to the passage of these acts was to implement land use planning through regulation. In cases where regulation was not possible, funds were made available for acquisition of lands of great environmental significance or sensitivity.

As stated in previous sections of this chapter, the explosive growth which occurred in the Planning Area through the 1960s and 1970s is expected to continue. The maintenance of water quality in the Planning Area will be an important, if not the most important, issue in the future. The state statutes discussed above, in parallel with the Federal Water Pollution Control Act of 1972 (P.L. 92-500) will provide the framework necessary to shape land and water use policy in the Planning Area.

I.11 OTHER COMMUNITY SERVICES AND FACILITIES

The focus on this study is not on how the Planning Area is to provide services for the projected population. It is assumed that the impact of sewage collection, treatment and disposal options will be examined only if:

1. The growth patterns generated are contrary to those planned (see Section I.2).
2. The proposed plan allows or may stimulate greater population growth or density than projected (Section I.1).

In order to project the impacts of item 2, baseline service levels must be examined.

I.11.1 Schools

Tampa/Hillsborough County has a county-wide education system which operates 141 schools. The type of educational services offered includes an adult day high school, an adult evening high school, a learning center, and an adult technical school as well as elementary schools (91), junior high schools (26) and senior high schools (11). The system handles 113,140 students and 41,500 adults and is the 17th largest school system in the United States. The Hillsborough County School System employs 6,758 permanent instructional personnel. The pupil to teacher ratio is just over 20. This ratio is low because many instructors are for vocational or exceptional study instruction and deal with less than 20 students per class.

The Tampa/Hillsborough County area also has higher education facilities. The University of Tampa, the University of South Florida, Florida College and Hillsborough Community College serve the Planning Area.

The funds for the school system are issued from several sources. Table I.11-1 shows the breakdown of funding for the 1978-1979 school year.

TABLE I .11-1

FUNDING SOURCES FOR HILLSBOROUGH COUNTY SCHOOL SYSTEM

Source	Amount	Percentage
Federal	$ 15,677,329	9
State	104,170,847	57
Local County	55,667,204	30
Fund Balance	7,311,033	4
	$182,826,413	100

Source: "Facts About Hillsborough County Schools," Public Information Office, Hillsborough County Schools, Tampa, Florida

Of the 182 million dollars, about 87 million went to instruction, and expenditures per full-time equivalent student amounted to $1,314.92. As can be seen, about 30 percent of the school system's funds are supplied by the local county. Thus, about $400 per pupil must be supplied locally.

I.11.2 Health

Tampa/Hillsborough County has a number of hospitals, medical schools and private physicians to handle the health needs of the area. There are more than 4,000 hospital beds in the 17 area hospitals (about one bed per 150 persons). As Tampa/Hillsborough County grows the medical facilities must expand to keep pace (two planned hospitals will include 360 beds.)

In addition to the hospitals there are almost 900 physicians and 240 dentists (about 700 persons per physician and 2600 persons per dentist). It is expected that the number of physicians and dentists will increase with increased population and that the local government will have to take little action in attracting physicians and dentists.

The Tampa/Hillsborough County area also has a medical school at the University of South Florida. Hillsborough Community College offers programs in registered nursing and nuclear medicine technology.

I.11.2 Utilities

The Planning Area's electric, water and sewer needs are served by a number of groups. In general, however, there are the services provided by the City of Tampa and services provided by Hillsborough County.

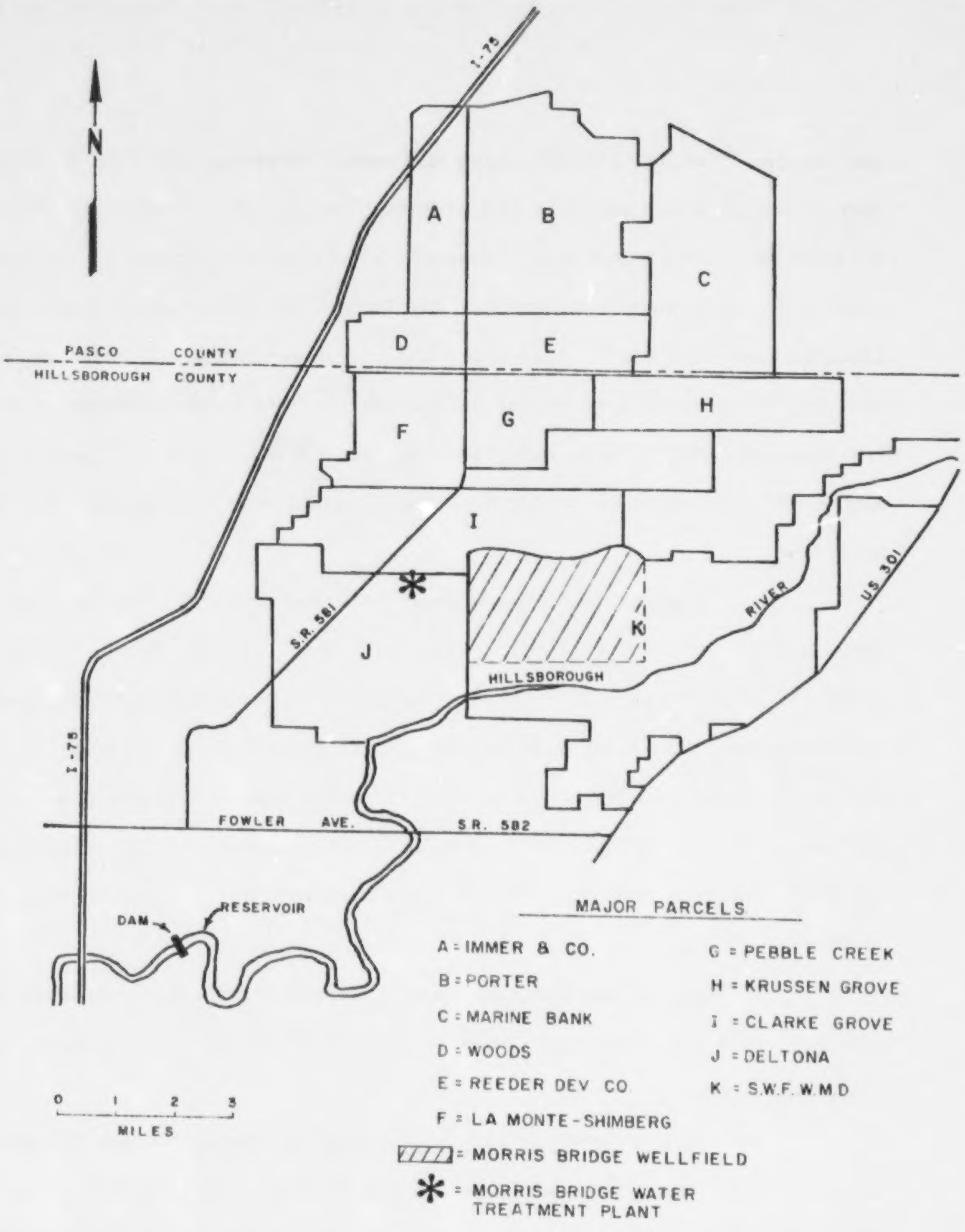
a. Water: The City of Tampa is the largest water user in the Planning Area. The raw water supply is primarily from the Hillsborough River and is supplemented by Sulphur Springs and the Hillsborough River Reservoir. Figure I.11-1 shows that the Hillsborough River originates in the northeast part of the Planning Area and flows southeast, bisecting the City of Tampa. Part of the drainage basin in the northeast section of the Planning Area is the Hillsborough River State Park. However, a substantial portion of the drainage area is in large parcel ownership. The Southwest Florida Water Management District owns part of the land along the river, including the state park. However, other large land owners such as Deltona and La Monte-Shimberg are in the drainage basin. It is expected that these areas, shown in Figure I.11-1, may be under development pressure as the Planning Area's population increases (Section I.1.

b. Sewers: Sanitary sewers are being developed for the City of Tampa and the entire city is planned to be sewered by year 1990. Figure I.11-2 shows the part of the city presently sewered. The Original Intergovernmental Agreement Area (OIGA), outside the city, utilizes the City of Tampa interceptors and treatment system as well as the waste treatment plant is located on Hookers Point. This plant presently handles all the treatment for the OIGA. At this time the City of Tampa does not plan another waste treatment facility.

The rest of the Planning Area utilizes either septic tanks or package plants. Presently, there are areas in the county in which septic tank violations occur.

c. Electic Power, Natural Gas, and Telephones: Tampa Electric Company (TECO) furnishes electricity to the Planning Area; further, TECO is interconnected to the Florida electric grid for reliability. TECO's present generating capacity is 1928-MWe.

The Peoples Gas System supplies natural gas and General Telephone Company of Florida provides communications for the Planning Area.



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S.R. 582
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RESERVOIR
MAJOR PARCELS
A = IMMER & CO.
B = PORTER
C = MARINE BANK
D = WOODS
E = REEDER DEV CO
F = LA MONTE-SHIMBERG
G = PEBBLE CREEK
H = KRUSSEN GROVE
I = CLARKE GROVE
J = DELTONA
K = S.W.F. W.M.D
▨ = MORRIS BRIDGE WELLFIELD
✱ = MORRIS BRIDGE WATER TREATMENT PLANT
0 1 2 3
MILES

SOURCE: HCPC, PERSONAL COMM, M. GURR AND K WALLER, 1979

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LARGE LAND OWNERSHIP
WITHIN RESERVOIR WATERSHED

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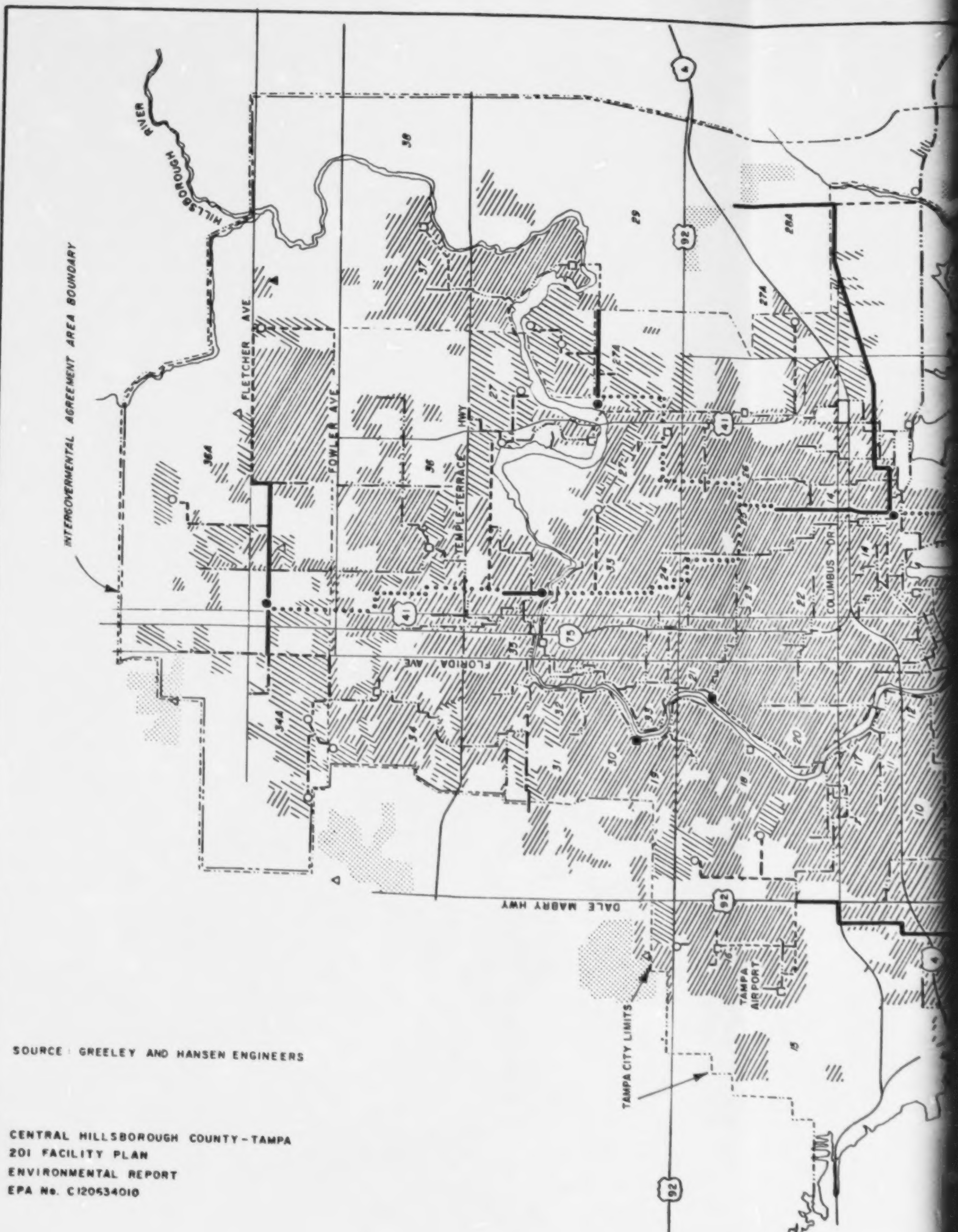
FIGURE I.11-1


HILLSBOROUGH RIVER
INTERGOVERNMENTAL AGREEMENT AREA BOUNDARY
FLETCHER AVE
FOWLER AVE
TEMPLE TERRACE HWY
FLORIDA AVE
COLUMBUS DR
DALE MABRY HWY
TAMPA AIRPORT
TAMPA CITY LIMITS
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SOURCE: GREELEY AND HANSEN ENGINEERS

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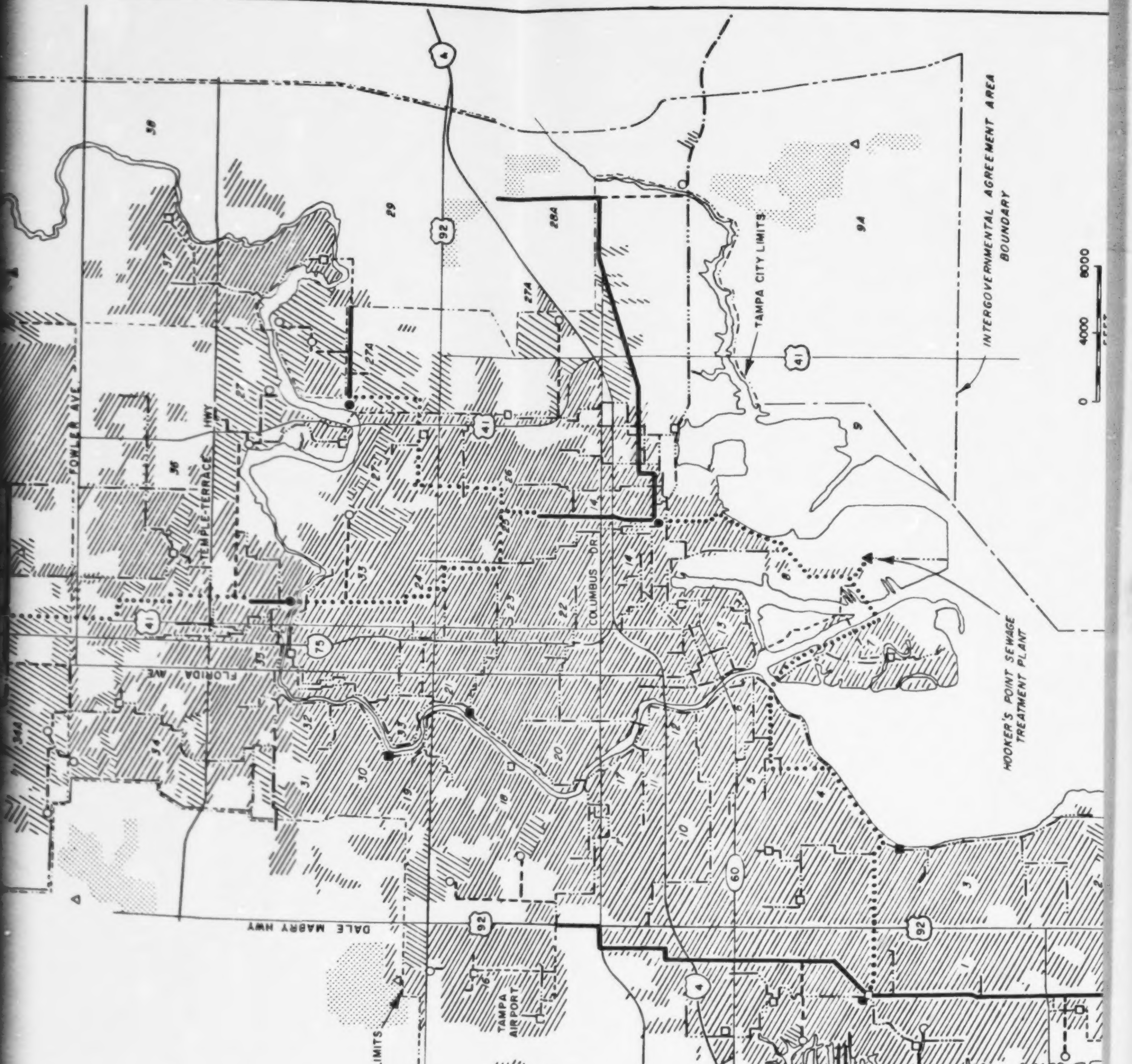
FOWLER AVE
TEMPLE-TERRACE HWY
FLORIDA AVE
COLUMBUS DR
DALE MABRY HWY
TAMPA CITY LIMITS
TAMPA CITY LIMITS
TAMPA CITY LIMITS
TAMPA AIRPORT
INTERGOVERNMENTAL AGREEMENT AREA BOUNDARY
HOOKER'S POINT SEWAGE TREATMENT PLANT
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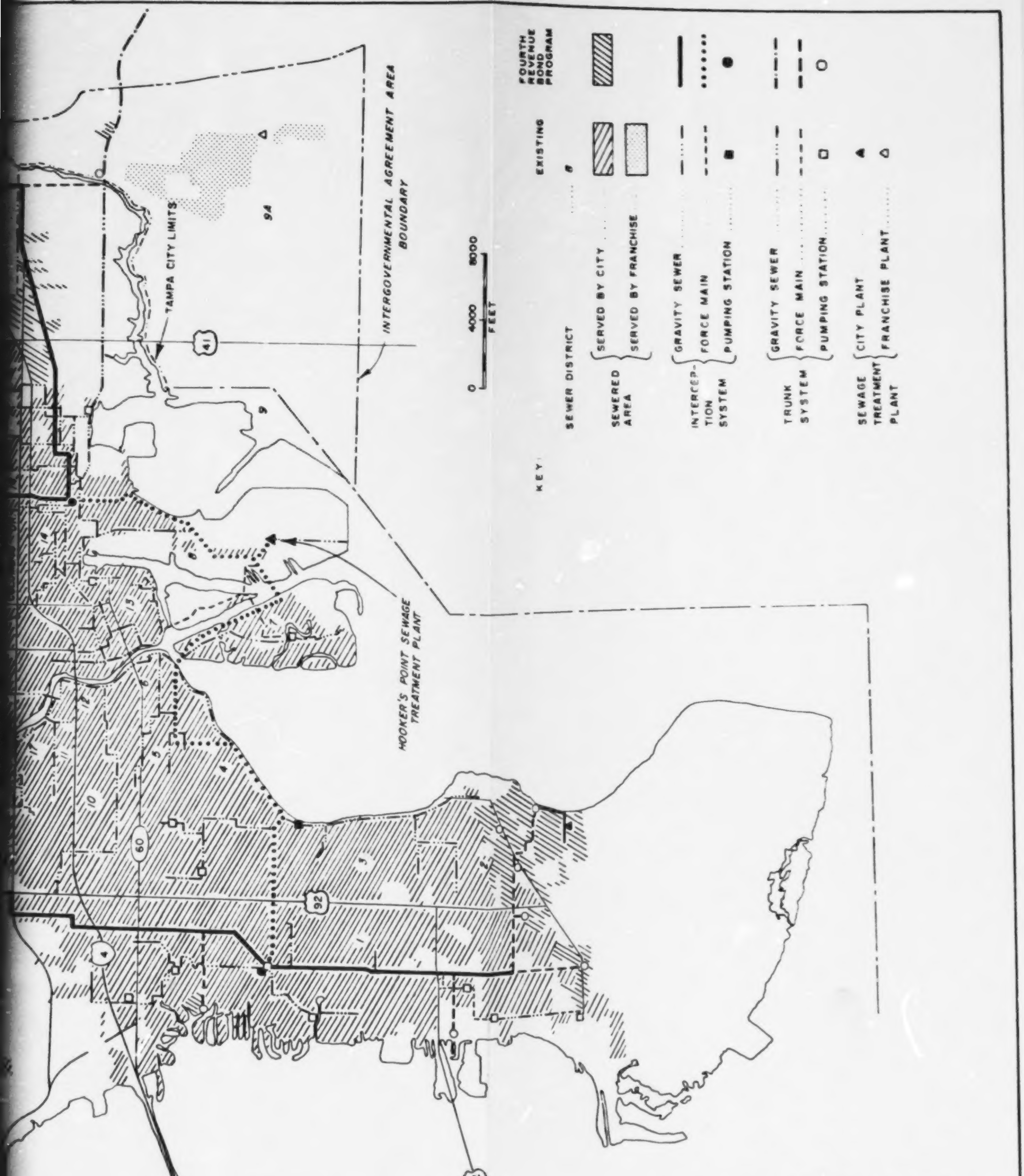
TAMPA CITY LIMITS
INTERGOVERNMENTAL AGREEMENT AREA BOUNDARY
HOOKER'S POINT SEWAGE TREATMENT PLANT
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92
4
92
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8000
FEET
KEY:
EXISTING
FOURTH REVENUE BOND PROGRAM
SEWER DISTRICT
SEWERED AREA
SERVED BY CITY
SERVED BY FRANCHISE
INTERCEPTION SYSTEM
GRAVITY SEWER
FORCE MAIN
PUMPING STATION
TRUNK SYSTEM
GRAVITY SEWER
FORCE MAIN
PUMPING STATION
SEWAGE TREATMENT PLANT
CITY PLANT
FRANCHISE PLANT

SEWERED PARTS OF CITY

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FIGURE I.11-2

I-295

I.12 TAXES AND BUDGETING

The two major local taxing entities within the Planning Area are the City of Tampa and Hillsborough County. Both entities gain most of their tax revenues from the property tax. Table I.12-1 shows the respective revenues for the city and county as reported in their most recent budgets. As can be seen, the City of Tampa obtains 30 percent of its operating funds from property taxes and the county 50 percent of its funds.

I.12.1 Property Taxes

The property tax for Hillsborough County in 1977 was 16.93 mills which yielded about $98,000,000, half of which went to the school board and the other half went to the operation of the county government. In terms of millage rate, Hillsborough County ranks 14th in Florida. However, in terms of monies generated only Dade and Duval Countaies are higher.

The millage rate for the City of Tampa was 9.8 for 1977, but was reduced to 9.75 for 1978. The funds generated comprise 30 percent of the revenues for the city. Further, Table I.12-2 shows the breakdown of expenditures. Presently, however, the Department of Sanitary Sewers is entirely revenue supported and derives no support from taxation revenue.

I.12.2 Sewerage Financing

The two taxing entities do not provide sewerage to the entire Planning Area. In fact, there are several means of treating waste: franchise systems, municipal waste treatment and septic tanks. The franchise systems are usually associated with mobil homes, restaurants, etc. Septic tanks are controlled by the Hillsborough County Health Department, and there is no user charge. The city and county charge for sewerage services.

a. City of Tampa: The City of Tampa is served by a municipal sewerage system with a treatment plant at Hookers Point. Presently there

TABLE I 12-1

REVENUE SOURCES FOR CITY OF TAMPA AND HILLSBOROUGH COUNTY

City of Tampa	Percent
Ad Valorem	30
Franchise Tax	9
Licenses and Inspections	4
Transfers	2
Federal	7
Utility Tax	17
State	13
Hillsborough County	2
Fund Balance	10
Other*	6
	100
Hillsborough County	
Federal Grants	1
State Sources	6
Property Taxes and Assessments	50
Licenses and Fees	12
Interest on Investments	1
Miscellaneous	8
Other	22
	100

*Interest, fines, forfeitures, other agencies, parks, recreation, convention center, and intergovernmental transfers.

Source: Annual Budget, 1978-1979; City of Tampa, Tampa, Florida. Budget, Fiscal Year 1977-1978; Hillsborough County, Tampa, Florida

TABLE I.12-2

PERCENTAGE DISTRIBUTION OF EXPENDITURES FOR THE CITY OF TAMPA

Expenditure	Percent of Budget
Police	26
Fire	18
Debt Service	4
Central Government	8
Public Works	19
Other	5
Parks, Recreation, Library, et al.	13
Transfers	7
	100

Source: Annual Budget, 1978-1979; City of Tampa, Tampa, Florida are four types of rates and charges imposed by the Department of Sanitary Sewers:

1. Sewer Improvement Charges: These charges are used to pay for the provision of a sanitary sewer in front of a lot. This financing approach is load-following in that the sewers are built to meet a demand, not anticipate it. As a consequence, the amount and location of the sewer improvement charge depends upon when the improvement was made. A summary of the improvement charges is shown in Table I.12-3. (Notice that prior to 1949 a different form of financing was used.) If a subdivider provides the eight-inch sanitary sewers, no sewer improvement charge is paid to the city.

2. Connection Fees: The financing of the interceptors, trunk lines, pumping systems and treatment plant is partially offset by charging a connection fee for new customers. Table I.12-4 shows the connection fees. Since this study is primarily interested in new construction, no review of connection fees for existing sections will be made.

3. Wastewater Disposal Charges: All users of the system pay a set rate ($0.57) for each 100 cubic feet of wastewater discharged to the sewer system. These funds are used to finance operation and maintenance, replacement, debt service and administration expenses.

4. Special User Charges: These rates vary with the user.

b. Hillsborough County: The sewer rates for Hillsborough County vary with the user. Financing for the county system is a combination of connection fees and user charges. Table I.12-5 shows the connection fees for residential uses. The fees vary with size and type of residential facility. Table I.12-6 shows the connection fees for commercial uses. The fees vary with the water meter size. Finally, monthly water charges are used for maintenance and operation costs. Table I.12-7 presents these charges.

TABLE I.12-3

SEWER IMPROVEMENT CHARGES

Date and Resolution	Meter Size	Amount/Month	Time/Months
No. 2187-C, July 26, 1949	5/8"	$ 1.00	240
No. 5966-C, July 27, 1954	5/8"	2.00	240
No. 4946-D, February 22, 1962	5/8"	2.00	240
No. 2536-F, June 5, 1973	5/8"	4.36	240
	1"	10.90	240
	1-½"	21.80	240
	2"	34.90	240
	3"	65.40	240
	4"	109.00	240
	6"	218.00	240

Source: Tampa/Hillsborough County: An Economic and Industrial Survey, Committee of 100, Greater Tampa Chamber of Commerce, Tampa, Florida

TABLE I.12-4

CONNECTION FEES FOR NEW SEWER CONSTRUCTION

Water Meter Size	Connection Charge
5/8"	$ 800.00
1"	2,000.00
1-½"	4,000.00
2"	6,400.00
3"	12,000.00
4"	20,000.00
6"	40,000.00

Source: Tampa/Hillsborough County: An Economic and Industrial Survey. Committee of 100, Greater Tampa Chamber of Commerce, Tampa, Florida

TABLE I.12-5

HILLSBOROUGH COUNTY CONNECTION FEES FOR RESIDENTIAL USERS

Type	Fee
Single Family Residence, Including Trailers On Residential Lots.	$360.00
Trailer Park Lots	300.00
Apartments, Including Apartment-Type Condominiums:	
1 - Bedroom	180.00
2 - Bedroom	225.00
3 - Bedroom	270.00
Duplex	540.00
Triplex	720.00
Cluster Homes and Multi-Family Not Classified Above	675.00

TABLE I.12-6

HILLSBOROUGH COUNTY CONNECTION FEES FOR COMMERCIAL USERS

Meter Size	Wastewater Charge
5/8" by 3/4"	$ 450.00
1"	1,125.00
1-½"	2,250.00
2"	4,500.00
3"	9,000.00
4"	13,500.00
6"	45,000.00
8"	78,750.00

TABLE I.12-7

HILLSBOROUGH COUNTY SCHEDULE OF WASTEWATER CHARGES

Meter Size	Minimum Wastewater Charge
5/8"	$ 11.60
1"	13.00
1-½"	19.50
2"	32.50
3"	104.00
4"	162.50
6"	325.00

I.12.3 Summary

There are two distinct systems now existing in the Planning Area - the system for the City of Tampa and the OIGA and the systems for Hillsborough County.

The sewerage improvement charge and connection fee do, within limits, place the burden of financing upon those persons who will use the system. Thus, persons in sections of the city which already have sewers do not subsidize growth.

I.13 SENSITIVE AREAS

Sensitive areas include portions of the Planning Area which would be adversely affected by sewer routing and subsequent development, areas in which hazards would occur which would cause property damage, or those areas where sewage treatment or disposal would have an adverse affect on public health.

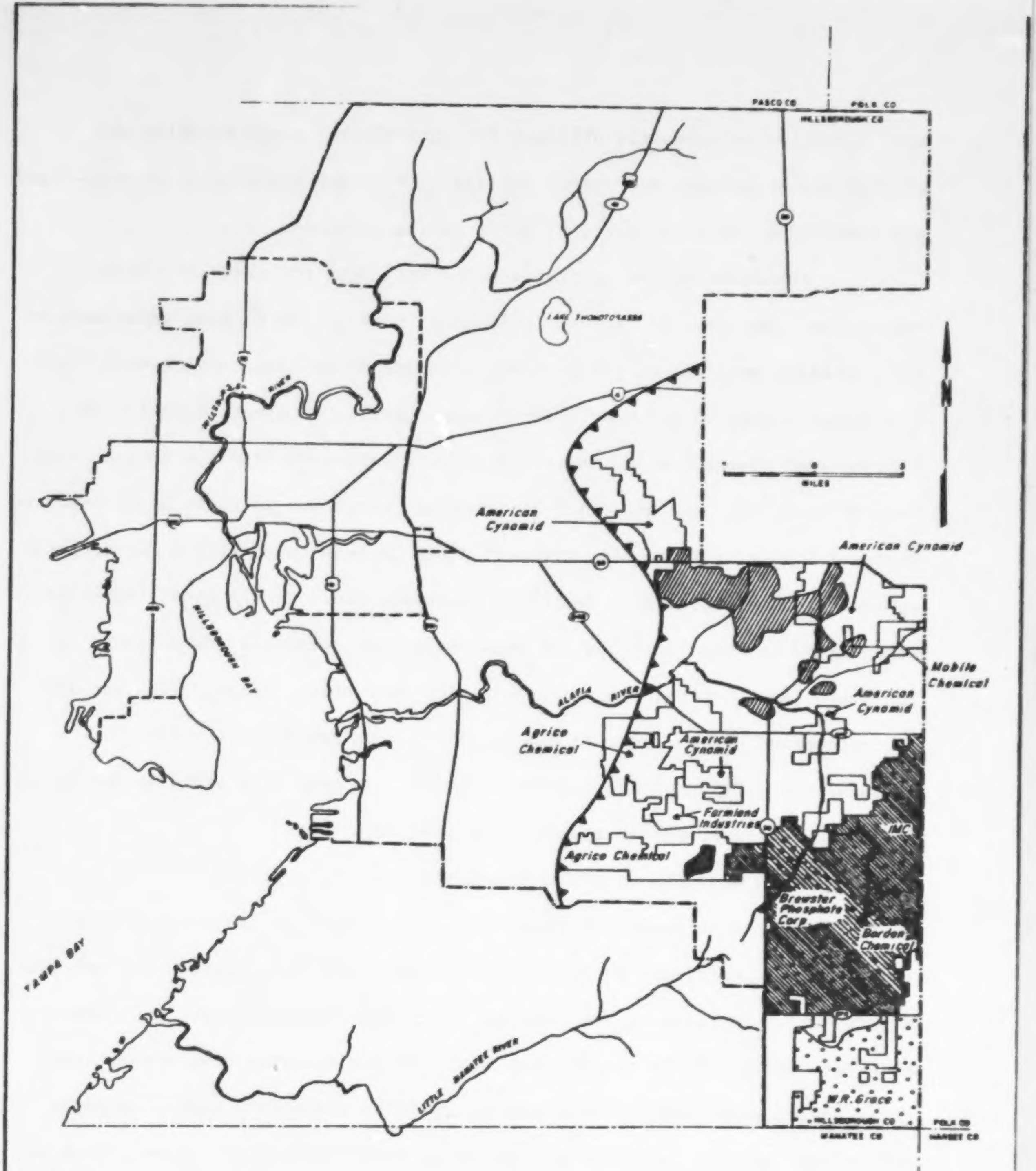
I.13.1 Demography Economics and Land Use

The Horizon 2000 Plan prepared by the Hillsborough County Planning Commission has provided the foundation with which to compare future growth and development of the Planning Area. It is recognized that the proposed wastewater treatment and collection facilities can have a significant impact upon land use and development patterns. The proposed facilities are designed to support the land use and development plan recommended in the Horizon 2000 Plan. Sensitive areas are discussed below.

a. Historical and Archaeological sites: Figure I.7-1 presents an inventory of sites in the Planning Area which have been cataloged by the state Division of Archives. The type of site, either historical or archaeological, is indicated along with the number of sites within the one square mile section of the Inventory Reference number.

b. Parks and Recreation Areas: The largest recreation areas in the county are Tampa, Hillsborough and Old Tampa Bays. The largest park in the Planning Area is the Hillsborough River State Park. Figure I.7-2 depicts all parks of regional, district and community significance in the Planning Area.

c. Large Land Owners: Figure I.13-1 shows large tracts in single ownership. The ownership indicates that two areas are likely to develop into large scale residential projects. The northern portion of the county contains


PASCO CO
POLK CO
HILLSBOROUGH CO
LAKE THONOTOSASSA
HILLSBOROUGH RIVER
HILLSBOROUGH BAY
TAMPA BAY
ALAFIA RIVER
LITTLE MANATEE RIVER
MILES
N
American Cynamid
American Cynamid
Mobile Chemical
American Cynamid
Agrico Chemical
American Cynamid
Farmland Industries
Agrico Chemical
IMC
Brewster Phosphate Corp.
Borden Chemical
W.R. Grace
HILLSBOROUGH CO
POLK CO
MANATEE CO
HARDEE CO

DATA SOURCES:

1. MARK HURD AERIAL PHOTOGRAPHS, 1972-73, SCALE 1:24,000
2. U.S.G.S. 7 1/2 MIN. QUADRANGLE TOPOGRAPHIC MAPS, SCALE 1:24,000
3. U.S.G.S., 1976 LAND USE AND LAND COVER MAPS 1972. LAND USE AND LAND COVER DATA ANALYSIS SYSTEM (LUDA) SCALE 1:126,720
4. TBRPC DRAFT MAP - PHOSPHATE HOLDINGS, SCALE 1:126,720
5. STOWASSER, W.F. AND C.W. HENDRY, JR 1975. THE MINERAL INDUSTRY OF FLORIDA 1973. INFO. CIRC. #89 DIV. GEOL. AND U.S.D.I.
6. WRIGHT, A.P. 1974 ENVIRONMENTAL GEOLOGY AND HYDROLOGY TAMPA AREA, FLORIDA. BUREAU OF GEOLOGY. DIV. TALLAHASSEE, SPEC. PUBL. 19.

KEY:

PHOSPHATE DEPOSITS
MINED AREAS AND TAILING PONDS
PHOSPHATE LAND HOLDINGS
DRI PROPOSED
DRI WITH APPROVED DEVELOPMENT ORDER

CENTRAL HILLSBOROUGH COUNTY - TAMPA
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EPA No. C120634010

LARGE LANDOWNERSHIP

DAMES & MOORE

FIGURE I.13-1

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many large tracts currently utilized for agricultural purposes while the eastern and southeastern portions contain significant deposits of phosphate and are controlled, in large part, by major mining companies.

Phosphate mining is regulated by stringent Hillsborough County ordinances, the Tampa Bay Regional Planning Council, The Florida Department of Environmental Regulation, the Southwest Florida Water Management District and the United States Environmental Protection Agency. Phosphate deposits in Hillsborough County are sufficient to allow mining well into the next century. Uses of reclaimed land projected by phosphate companies in their Development of Regional Impact (DRI) studies are varied and include residential, recreational, agricultural and wetlands. Reclaimed phosphate land in Polk County adjacent to urban areas has been utilized for residential and commercial development while reclaimed lands further removed from cities have been utilized primarily for recreation and agriculture. A similar pattern is projected for the southeastern portion of the county, although this area will probably not be available for residential use until the year 2000.

Land holdings in the northern portions of the county are under greater pressure to develop because they are adjacent to the major interstate transportation corridors I-75, the I-75 Bypass, I-4, U.S. Highway 301 and State Highway 39). Portions of the Planning Area, especially near the I-75 Bypass, have been designated in the Horizon 2000 Plan for suburban development areas. Other areas, exlcusive of the Hillsborough River State Park (which is major public open space), have been designated as rural development areas. Much of this area is in large agricultural tracts. As the pressures for development of these areas for urban/suburban uses increase, the pressure for variances to the Horizon 2000 Plan will increase.

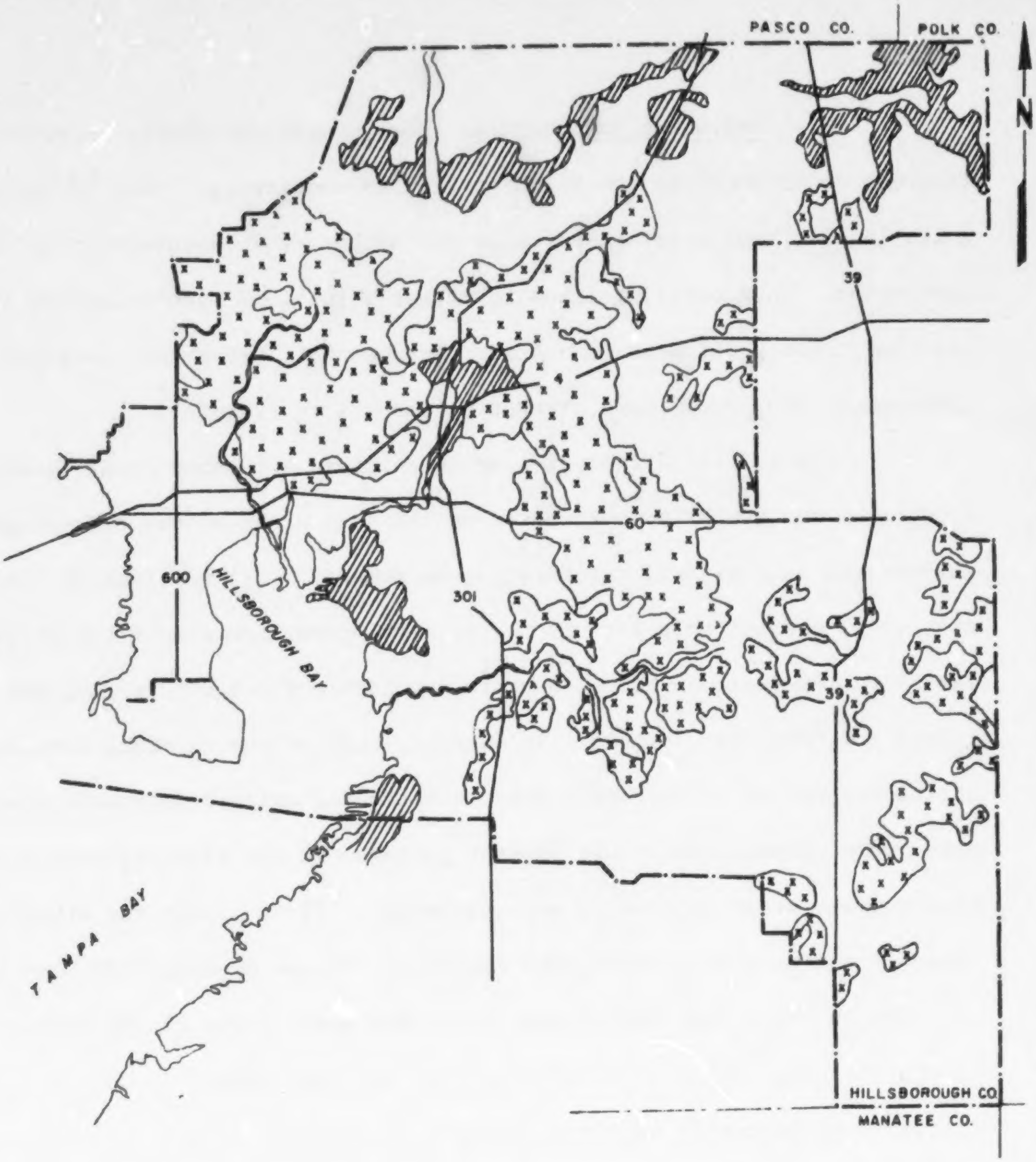
d. Soils and Agriculture: Loss of agriculturally important soils to urban development in the Planning Area is continuing. Many of the existing soils in the Tampa area are suitable for either urban development or citrus production. This conflict leads to higher value land uses competing against existing, less profitable land uses. In the past, urban and residential development has proven more attractive than citrus farming.

Figure I.13-2 indicates areas suitable for urban development, citrus production and truck farming, based on the soil atlas of the county and interpreted uses of soil capability. In general, most portions of the Planning Area which are suitable for urban land development are also the most suitable for citrus production while those areas suitable for truck farming are not well suited for urban development. In general, much of the existing development in the county exists on the soils most suitable for urban development since these areas were chosen first. Development patterns in the Planning Area have followed the areal pattern of suitable soils. It is likely the urbanization of these citrus producing areas will continue. If the Horizon 2000 Plan is accurate in predicting development patterns, most of the citrus producing soils in the Planning Area will be urbanized by the year 2000.

I.13.2 Biologically Sensitive Areas

Two habitats are of most concern from the standpoint of biological sensitivity. These are the wetlands and riverine forest habitat and the sand hill habitat.

a. Wetlands: Wetland areas, shown in Figure I.4-14 are particularly important to high biological diversity and high net productivity. Additionally, most of these areas provide for enhancement of hydric soils and aquatic plants, flood water storage, aquifer recharge and removal of pollutants.


PASCO CO.
POLK CO.
N
39
4
60
600
301
HILLSBOROUGH BAY
TAMPA BAY
39
HILLSBOROUGH CO.
MANATEE CO.

KEY:

☒ AREAS WHICH ARE SUITABLE FOR BOTH AGRICULTURAL USE AND URBAN DEVELOPMENT

▨ SOILS SUITABLE FOR TRUCK CROPS

SOURCE: FLORIDA DEPARTMENT OF ADMINISTRATION, 1975

LAND AREAS WHERE URBAN AND AGRICULTURAL DEVELOPMENT CONFLICT

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FIGURE I.13-2

Mangrove Swamps - Occur primarily south of the Alafia River around Bullfrog Creek, around most of McKay Bay, especially near the Tampa Bypass Canal and in scattered patches along Hillsborough Bay.

Salt Marsh - Is common near MacDill Air Force Base in the Old Tampa Bay side, on the eastern shore of Tampa and Hillsborough Bays and adjacent to most mangrove swamps.

Riverine Forest - Includes cypress forest and hardwood forest. These habitats are common along most rivers, creeks and drainage areas in the Planning Area and are especially important in protecting the watershed, preventing erosion and reducing turbidity in associated waters. The most sensitive of these habitats is the Hillsborough River, where all these vegetation types are present. Additionally, most of the protected plant species are located along the Hillsborough River.

Cypress Domes - Are perched wetlands and are very important for a variety of waterfowl species as well as for water conservation and purification. These domes are abundant in the northern half of the Planning Area.

Freshwater Marshes - Provide habitat for a wide variety of animals, particularly water fowl, and support high plant productivities. These marshes, like the cypress domes, occur throughout the northern half of the Planning Area.

b. Sand Hill: Sand hill habitats are defined primarily by the vegetation they support, usually turkey oak/longleaf pine associations, although other scrub oak/pine associations have been described as sand hill by various authors. These habitats are important in supporting a unique community structure, often including one or more threatened or endangered species, as well as providing an important food source for grazing herbivores. Sand hill habitat is spotty in distribution in the Planning Area, but significant areas occur in "nature's classroom" and near Trout Creek, both along the Hillsborough River.

I.13.3 Topography, Geology and Soils

a. Topography: The Planning Area is generally of low relief with elevations ranging from sea level to a maximum of just over 150 feet in the southeastern corner. The only slopes which exceed 10 percent are scattered along the banks of the Hillsborough and Alafia Rivers.

b. Geology and Soils: The carbonate rocks underlying the Planning Area are susceptible to sinkhole formation by solution and collapse. Predicting where sinkholes will occur is difficult. However, the location where sinkholes are common has been plotted and is illustrated in Figure I.4-9. Areas with the greatest potential for sinkhole development are northern portions of the City of Tampa, the Temple Terrace area and the area around Brandon.

Weathering of the surficial sediments has produced a number of different soil types with diverse properties. Figure I.4-11 indicated the suitability of soils for several purposes. In terms of soils suitability, sensitive areas occur along the coastal zone, north of and along the Hillsborough River, and in the northeastern portion of the county.

I.13.4 Hydrology

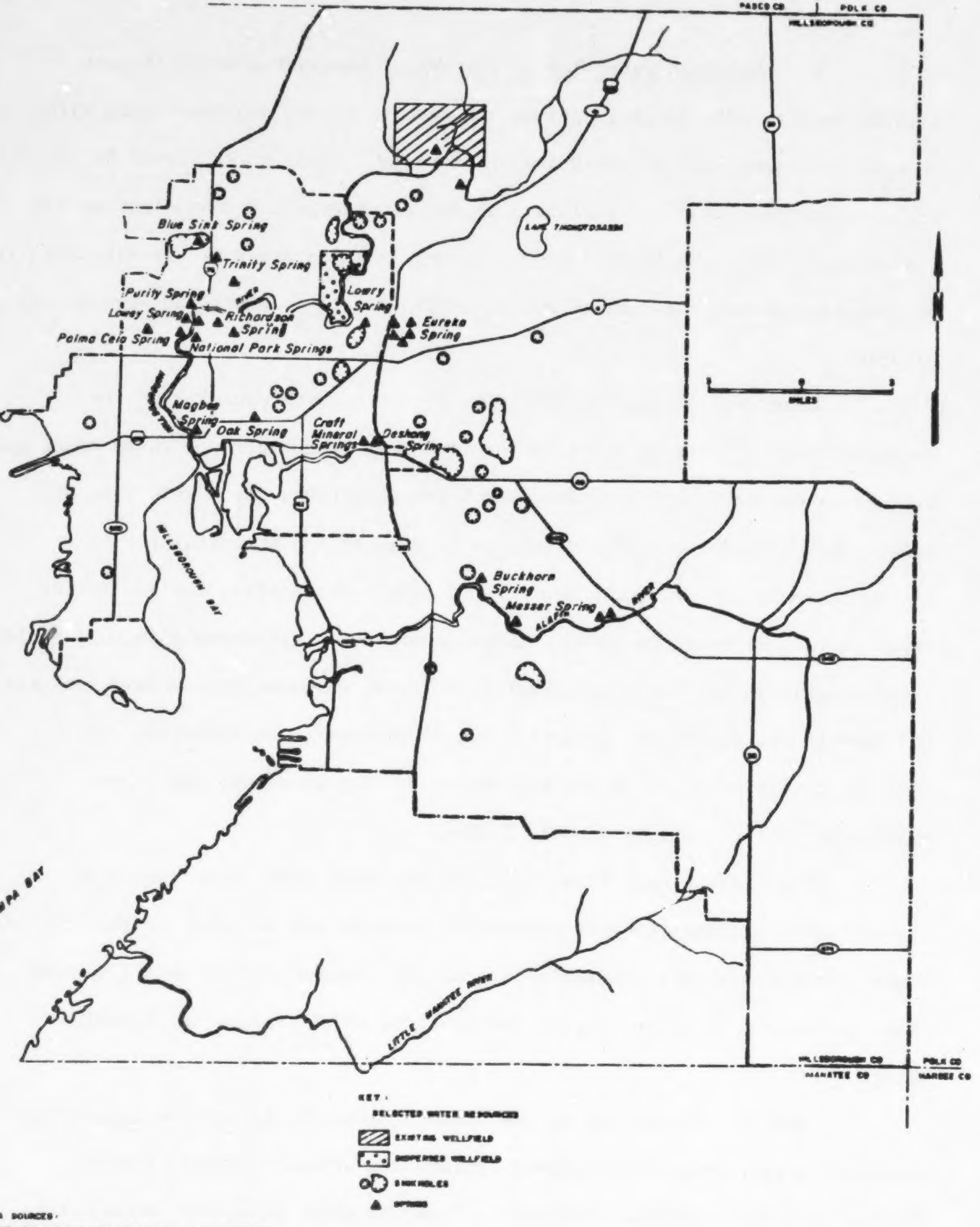
a. Flood Plains and Flood Prone Areas: This map (Figure I.5-1) depicts the approximate 100-year hurricane and river flood zones along with other major flood prone areas. In general, the area noted in Figure I.5-1 provides an approximation of where subsequent residential and urban development should be avoided.

b. Selected Water Resources: Water supply resources (Figure I.13-3) such as well fields, springs and reservoirs are depicted along with physical features such as sinkholes and springs. These areas should be avoided during route selection to preclude problems of underground contamination and system reliability. Residential development in these areas is undesireable due to potential ground and surface water quality problems as well as foundations hazards.

Other hydrologically sensitive areas in the Planning Area are recharge areas where rock crops out or lies near land surface. These areas and sinkhole prone areas are locations which are unsuitable for septic systems, sewage lagoons and wastewater discharge because of the potential for contamination of the Floridan Aquifer. Sinkhole prone areas include active areas as well as inactive areas. Large ground water withdrawals in well fields significantly reduce the potentiometric surface, encouraging downward leakance and thereby increasing the potential for development. In addition, the lowering of the water table and the reduction of lake levels can stress vegetation in the vicinity of well fields.

The Hillsborough River is a surface water body which should be classified as a sensitive area because it supplies the majority of the City of Tampa's drinking water. Contamination of this source will icrease treatment costs or degrade water quality to the point of unsuitability for drinking water.

Many of the springs in the Planning Area should also be considered sensitive areas, especially Sulphur Springs and Lithia Springs. Sulphur Springs is used to augment withdrawals from the Tampa Reservoir while Lithia Springs is a large contributor of base flow to the Alafia River.


PASCO CO
POLK CO
HILLSBOROUGH CO
Blue Sink Spring
Trinity Spring
Purity Spring
Lowry Spring
Richardson Spring
Palma Ceia Spring
National Park Springs
Lowry Spring
Eureka Spring
LAKE THONOTOSASSA
N
2 0 2
MILES
Magbee Spring
Oak Spring
Craft Mineral Springs
Deshong Spring
HILLSBOROUGH BAY
Buckhorn Spring
Messer Spring
ALAFIA RIVER
TAMPA BAY
LITTLE MANATEE RIVER
HILLSBOROUGH CO
MANATEE CO
POLK CO
HARDEE CO
KEY:
SELECTED WATER RESOURCES
▨ EXISTING WELLFIELD
PROPOSED WELLFIELD
SINKHOLES
▲ SPRINGS

DATA SOURCES:

1. HEATH, R.C. AND SMITH, P.C., 1954 GROUNDWATER RESOURCES OF PINELLAS COUNTY, FLA. U.S. GEOLOGICAL SURVEY AND FLORIDA GEOLOGICAL SURVEY, TALLAHASSEE
2. HENKE, ET AL., 1961

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EPA No. C120634010

SELECTED WATER RESOURCES OF THE PLANNING AREA

DAMES & MOORE

FIGURE I.13-3

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I.13.5 Summary

The most obvious sensitive areas occur along the coastal and riverine portions of the Planning Area. Ecologically sensitive floral and faunal communities exist in these wetlands areas. In addition to being in a biologically sensitive area, the Hillsborough River is the main source of Tampa's drinking water.

The Floridan Aquifer is the main source of ground water supply for the county and is subject to pollution from surface water and septic systems in recharge areas. Thus, areas of porous soils, areas where the limestone is exposed at the surface and sinkhole areas are sensitive.

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APPENDIX A

Assessment of Indirect Impacts on Wetlands in the Deltona and the Northeast Sector Study Areas of the Central Hillsborough County-Tampa 201 Facility Plan

ASSESSMENT OF INDIRECT IMPACTS ON WETLANDS
IN THE
DELTONA AND THE NORTHEAST SECTOR STUDY AREAS
OF THE
CENTRAL HILLSBOROUGH COUNTY - TAMPA 201 FACILITY PLAN

1.0 INTRODUCTION AND SCOPE

Undeveloped areas are usually most susceptible to indirect impacts that result from sewering. The most important ecological effect is generally agreed to be the displacement of plant and animal communities by societal development in wetlands. This study identifies and qualitatively and quantitatively assesses those wetlands susceptible to indirect impacts of development following sewering in selected areas of the Hillsborough County - Tampa 201 Facility Plan.

The areas included in these evaluations were derived from on-going studies of the overall 201 Facility Plan and from consultation with the U.S. Environmental Protection Agency. The study areas include wetlands in the Deltona planning area, specifically the proposed Tampa Palms and Trout Creek (= New Town) subdivisions, and the Northeast Sector of the city of Tampa. Each of these areas comprises large areas of wetlands generally unaffected by societal development. Following sewering into these areas, however, rapid development is likely with concomitant deleterious impacts on these important habitats.

2.0 DATA ACQUISITION AND ANALYSIS

The boundaries delimiting the areas of interest within the Deltona Study Area were defined by Applications for Development Approval submitted to the Tampa Bay Regional Planning council by the respective developers. Primary study areas in the northeast sector were determined by locating undeveloped wetlands from topographic maps and aerial photographs.

Identification of wetlands was made possible with the use of low altitude, black and white aerial photography from which areas displaying the visual characteristics of wetland communities could be delineated. The soil classification of the study areas was obtained from the Hillsborough County Soil Survey (1958). Flood plain data were obtained from the Tampa Palms and Trout Creek Development plans and the Southwest Florida Water Management District (SWFWMD). Aerial surveys and "ground truthing" were also conducted with emphasis on the proposed Tampa Palms Development and the northeast sector study areas.

Qualitative assessment of wetlands in the study areas were based on the following criteria:

- Size - wetlands larger than 5 acres were generally afforded a higher rating.
- Contiguity to permanent water bodies - wetlands interfacing directly with flowing streams were considered of higher importance.
- Flood Plain - Those wetlands located within the 25 year flood stage were given higher qualitative ratings than those at higher elevations.
- Vegetation Types - Wetlands offering high or unique habitat diversity and/or comprising a dominance of wetland species were assigned higher importance.

These criteria were used in assigning wetlands in the study areas to one of three categories:

- Category A - Wetlands of particularly high quality; secondary development in these areas following sewering is considered a significant impact, for purposes of this study.
- Category B - Transitional wetlands of generally high quality but, as a result of existing or approved disturbances from societal activities, represent habitats less sensitive to indirect impacts of sewering.
- Category C - Wetlands of generally low quality. These habitats are typically small wetlands, physically and hydrologically isolated, and generally provide low fish and wildlife value.

Following evaluation of wetlands in the study areas, maps were developed that delineated the areal extent of each of the respective categories. In addition, the total acres of wetlands potentially affected by secondary development were calculated for each study area.

3.0 RESULTS OF SURVEY

3.1 Area Description

The study areas are located directly northeast of the highly urbanized Tampa area and are illustrated in Figures 3-1 through 3-3. Major highways include I-75, which proceeds north between Tampa and the study area, S.R. 581, which goes northeast through a portion of the area of interest, and U.S. 301, passing along the southeast of the study area. The Hillsborough River flows from the east through the area. Existing societal development here ranges from absent or sparse in the Deltona study area to moderately heavy in the Northeast Sector Study Area of the city of Tampa. Also currently under construction in this area are components of the U.S. Army Corps of Engineers Lower Hillsborough Flood Detention Area (LHFDA). This project is scheduled for completion during 1980 and includes a dam (S-155) and a levee (112-N) maintained by SWFWMD, both of which will modify projected flood levees for part of the Deltona Study area. The majority of this area is either pine flatwoods/rangeland or wetlands. Pine flatwoods is the common upland vegetative community in much of this area of Florida, pines, palmettos, and native grasses comprising the dominant vegetation. Rangeland is also common in Hillsborough County consisting of flatwoods altered by the removal of pines and periodic burning and/or by cultivation of pasture grasses for livestock production. Wetlands in the county are primarily in the north and east.

3.2 Wetlands Description

A large portion of the study area is located within the 100 year floodplain. Although soils within this floodplain are generally rated as having severe limitations for urban development, wetland communities are generally associated with these soils types. The proportion of wetlands, by category, are listed in Table 3-1. These hydric habitats consist of forested wetlands, such as riverine forests along the major river systems and tributaries, and cypress domes, which are isolated from conventional drainage patterns; and non-forested wetlands, such as fresh water marshes.

TABLE 3-1

DISTRIBUTION OF WETLANDS BY CATEGORY IN THE DELTONA AND NORTHEAST SECTOR STUDY AREAS. NUMBERS REPRESENT ACRES OF WETLANDS.

Study Area	Categories			Total
	A	B	C	
Deltona				
Tampa Palms Site				
Without Cypress Creek Levee	1825	99	16	1940
With Cypress Creek Levee	1440	484	16	1940
Trout Creek Site	1133		20	1153
Northeast Sector	965		132	1097

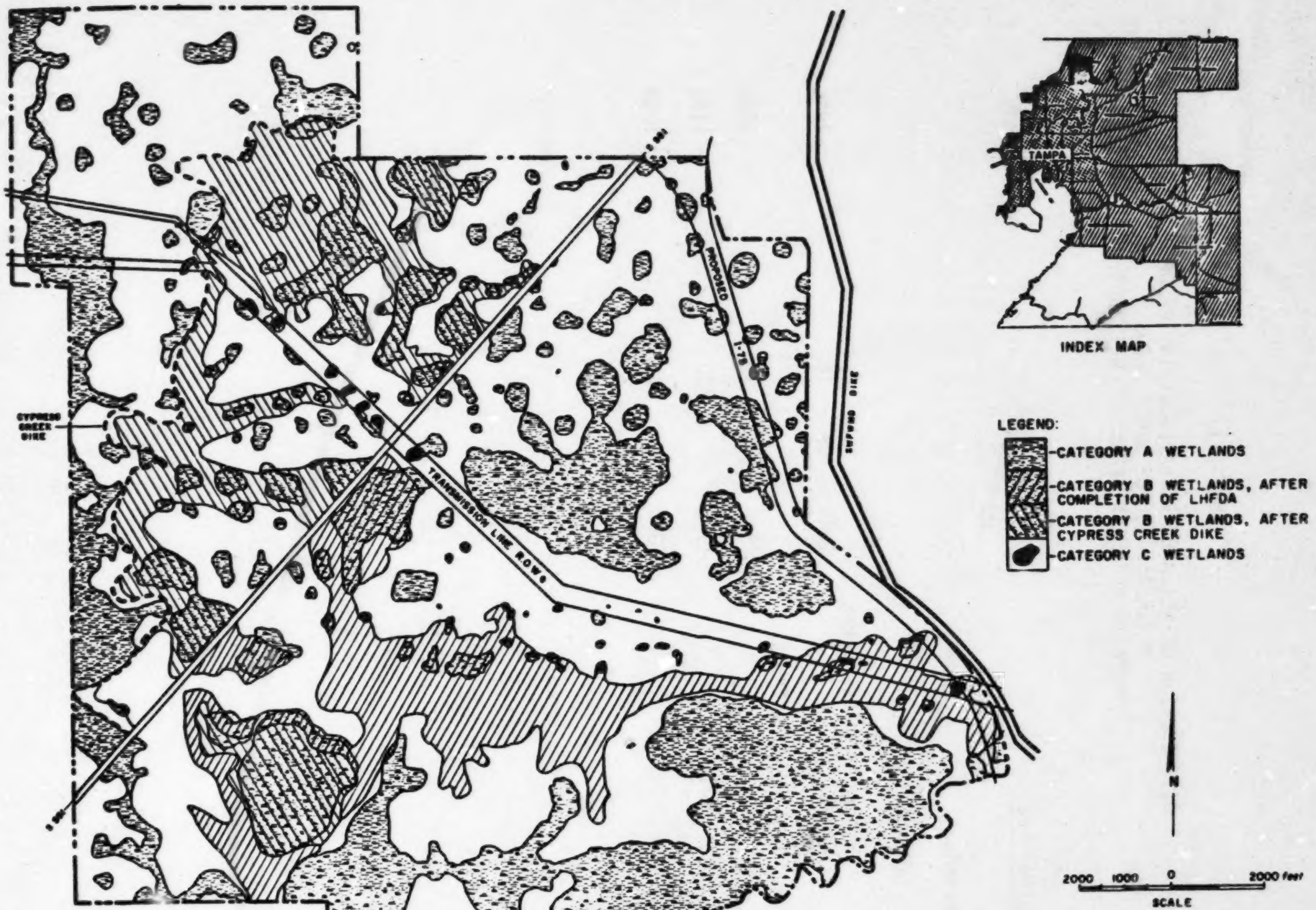
TAMPA
INDEX MAP
LEGEND:
-CATEGORY A WETLANDS
-CATEGORY B WETLANDS, AFTER COMPLETION OF LHFDA
-CATEGORY B WETLANDS, AFTER CYPRESS CREEK DIKE
-CATEGORY C WETLANDS
PROPOSED I-75
TRANSMISSION LINE ROWS
CYPRESS CREEK DIKE
N
2000 1000 0 2000 feet
SCALE

Figure 3-1. Wetlands on Tampa Palms Study Site

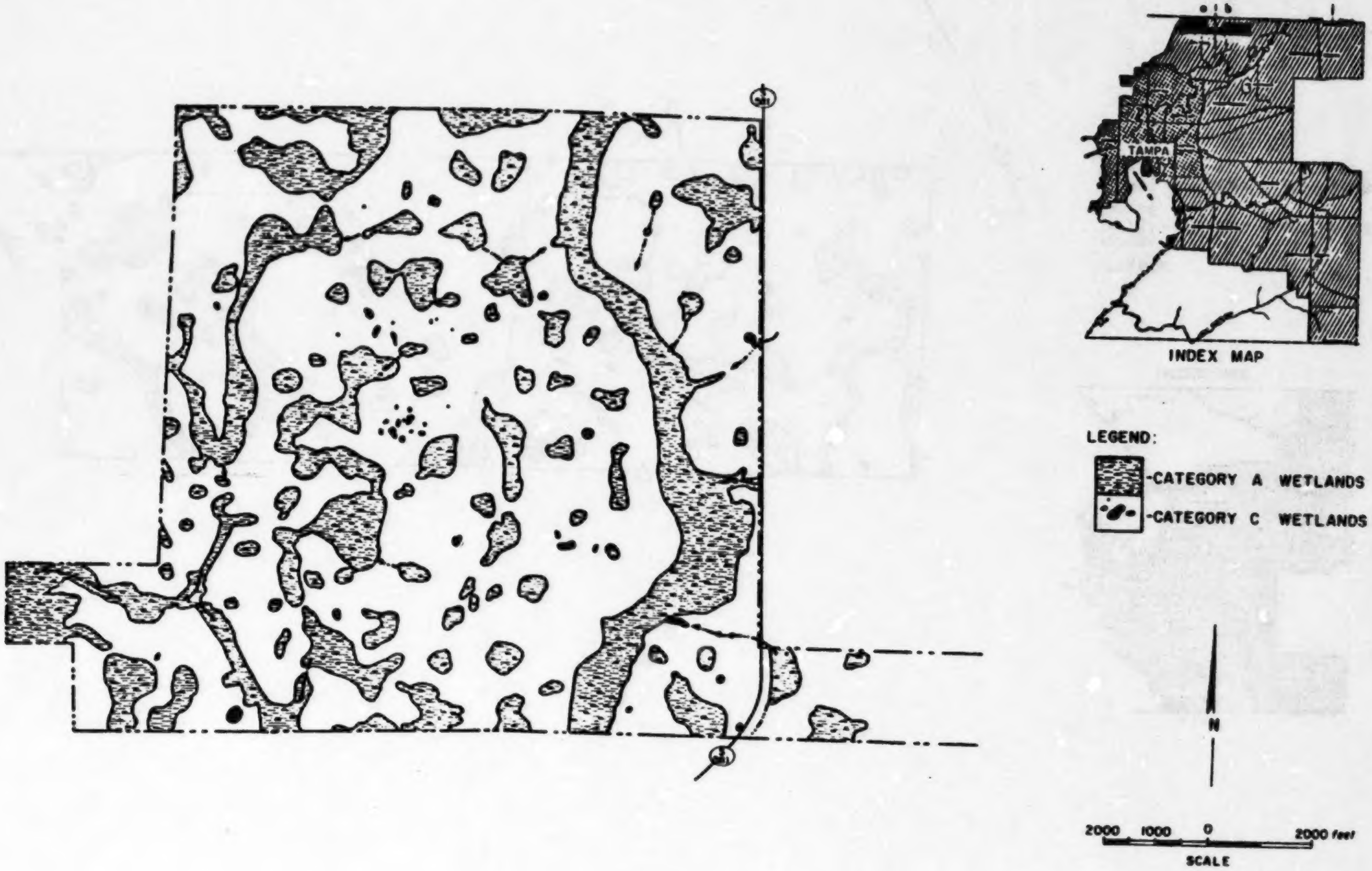
INDEX MAP
TAMPA
LEGEND:
-CATEGORY A WETLANDS
-CATEGORY C WETLANDS
N
2000
1000
0
2000 feet
SCALE

Figure 3-2a. Wetlands on Trout Creek Study Site

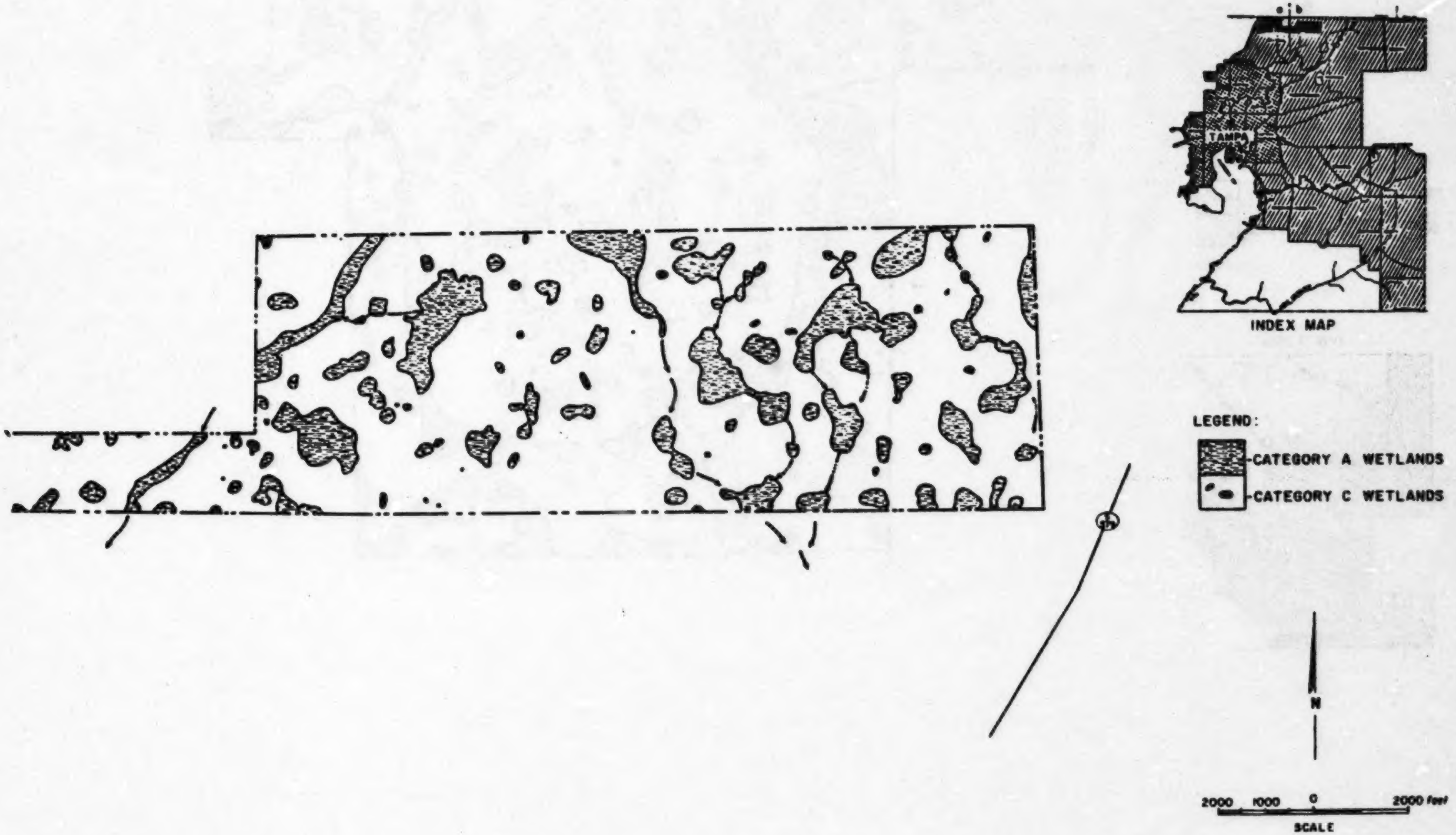
TAMPA
INDEX MAP
LEGEND:
CATEGORY A WETLANDS
CATEGORY C WETLANDS
N
2000 1000 0 2000 feet
SCALE

Figure 3-2b. Wetlands on Trout Creek Study Si

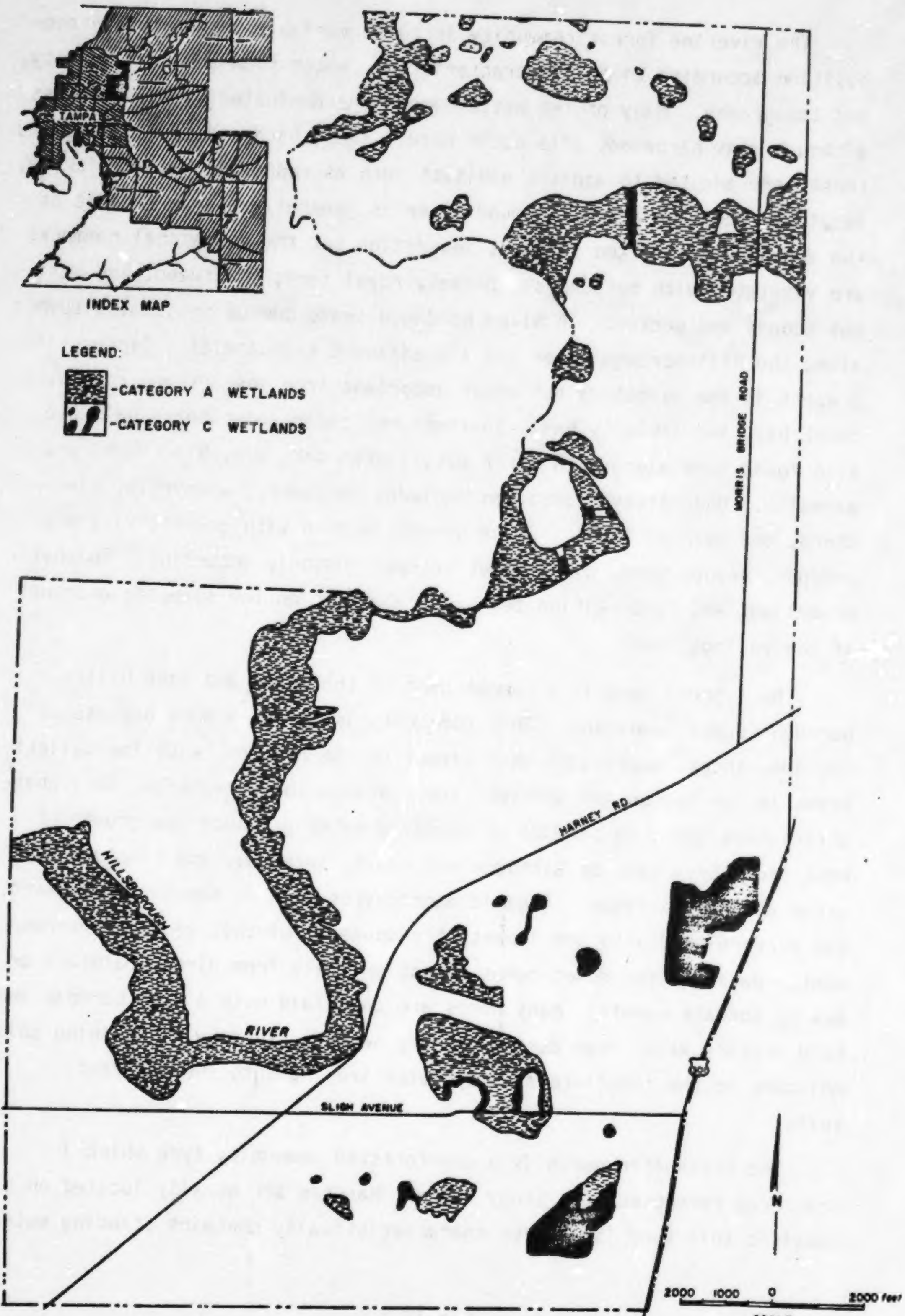
INDEX MAP
TAMPA
LEGEND:
-CATEGORY A WETLANDS
-CATEGORY C WETLANDS
MORRIS BRIDGE ROAD
HARNEY RD.
HILLSBOROUGH
RIVER
SLIGH AVENUE
N
2000 1000 0 2000 feet
SCALE

Figure 3-3. Wetlands on Northeast Sector Study Site

The riverine forest community is quite variable in vegetative composition according to soil characteristics, water flow and availability, and topography. Many of the wetter areas are dominated by bald cypress although many hardwoods also occur here. These hardwood species include those more adapted to aquatic habitats such as red maple, water hickory, sweetgum, and blue beech. Ground cover is generally sparse because of the dense overstory and frequent inundation but the occasional hammocks are vegetated with buttonbush, privet, royal fern, smartweed, and various sedges and grasses. A mixed hardwood swamp community is also common along the Hillsborough River and its adjacent tributaries. Cypress is present in the overstory but other important tree species are redbay, sweet bay, and loblolly bay. Southern red cedar and cabbage palm are also found here along with water oak, laurel oak, elm, black gum, and magnolia. Understory vegetation includes gallberry, waxmyrtle, hawthorn, and several ferns. Since growth is rich with grapes, virginia creeper, pepper vine, and trumpet creeper commonly occurring. Epiphytic bromeliads and resurrection ferns are abundant on the sweeping branches of the various oaks.

The cypress dome is a common part of the north and east Hillsborough County landscape. This community is called a dome because of its lens-shaped appearance when viewed on the horizon, with the tallest trees in the center and shortest trees around the periphery. Soil characteristics and long periods of standing water preclude the growth of most other tree species although red maple, sweetgum, and blackgum will occur around the edges. Aquatic macrophytes such as coontail, duckweed, and pickerelweed also are important components of this aquatic environment. Water in the domes comes almost entirely from direct rainfall or nearby surface runoff. Many domes are underlaid with a clay hardpan and hold surface water even during the dry seasons, thereby maintaining soil moisture in the immediate area by water seeping into the adjacent soils.

The freshwater marsh is a non-forested community type which is scattered throughout the study areas. Marshes are usually located on a specific soil type (Sc) which characteristically contains standing water for large portions of the year. These areas are commonly circular in shape and contain a number of zonal plant communities, such as palmetto, wax myrtle, and gallberry, around the moist perimeter of the marsh. Carpet grass, panic grass, pennywort, and smartweed are found where the water reaches a depth of a few inches. As the water depth increases, maidencane and pickerelweed become prevelant. In many of these marshes, maidencane is a monotypic species in the center of the community making these areas easy to recognize from aerial photographs.

The animal productivity within the wetlands is quite high and diverse. Invertebrate life is generally higher in the floodplain of the riverine forest than in the actual mainstream of the dominant slough, stream, or river. Midges, dragonfly nymphs, segmented worms, and small crustaceans are common in the floodplain areas. Insect larvae and crustacea are a major contributor to the faunal community in most alluvial rivers and comprise an important component of the food supply for fish and other vertebrates. Fish found in the open channel areas of the major water courses include gar, bowfin, killifish, largemouth bass, bluegill, and tilapia. Many of these species also occur in other areas of the floodplain where they have been transported during high water. The back water and slough areas generally contain a more diverse fish population, including various shiners and sunfish in addition to those species already listed.

The aquatic invertebrates in the cypress dome or marsh ecosystems are less diverse than that in the riverine system. Mayfly nymphs are common but midge fly and gnat fly larvae are the dominant benthic fauna. The fish community is composed primarily of mosquito fish, killifish, sunfish, and various minnows. Fish are more common in those domes and marshes that contain permanent water but these populations seldom attain large numbers.

Amphibians are quite abundant in the wetland communities and require standing water for reproduction. Areas with permanent water are attractive to many newts, sirens, salamanders, and frogs, most of which rely heavily on the insect life found here for their food supply. Reptiles common to these areas include the alligator, snapping turtle, cooter, chicken turtle, mud turtle, softshell turtle, cottonmouth, mud snake, and various water snakes in the riverine forest habitat and the green snake, ribbon snake, rough green snake, yellow lipped snake, and brown snake in the drier areas.

Birds make up the most varied group of vertebrates utilizing wetland habitats. Many species of waterfowl and wading birds depend exclusively on abundant aquatic life in wetlands for food and the dense vegetation and relative seclusion for protection. Many of these aquatic birds are residents but great numbers of migrants come into this area each year during the migratory seasons. Ducks feed on aquatic vegetation and/or invertebrates depending on the species while herons, egrets, ibises, and other wading birds feed primarily on aquatic invertebrates, fish, and amphibians.

The wetland habitats are attractive to several species of mammals. Those that depend on aquatic habitats include the mink and otter but these species are generally uncommon. The raccoon, opossum, armadillo, skunk, gray fox, and bobcat may find much of their food and shelter requirements in wetlands, but also utilize the upland habitats. This is also true of the cottontail, gray and fox squirrels, and whitetail deer. These animals would not be extirpated should the wetlands be removed but they would definitely find the area less useful for supporting their populations.

3.3 Deltona Study Area

3.3.1 Tampa Palms Site

Wetlands Prior to Completion of LHFDA

Approximately 36 percent, or 1940 acres, of the proposed Tampa Palms site is presently occupied by wetlands (Figure 3-1). The several types of wetlands that occur here range in size from the extensive riverine forests on the southern portion of the property in the Hillsborough River floodplain (approximately 698 acres) and western portion near Cypress Creek (approximately 350 acres), to the many scattered cypress domes and freshwater marsh communities found throughout the site. The remaining 892 acres of wetlands not associated with the riverine forest are largely very high quality wetlands (Category A, Table 3-1) with only 16 acres currently disturbed or isolated (Category C, Table 3-1). These low quality, Category C wetlands are primarily resultant from the maintenance of a transmission line right of way diagonally across the site.

Changes in Wetlands Resulting from the LHFDA Project

The establishment of the SWFWMD dike located to the east of the proposed Tampa Palms site will result in a change in flood conditions, primarily in the northern portion of the Hillsborough River floodplain located on the site. The 99 acres of transitional wetlands (Category B, Table 3-1) illustrated in Figure 3-1 are those hydric habitats that will be transformed to more mesic areas as of result of the SWFWMD dike along the east side of the site. The majority of these affected wetlands parallel the riverine forests of the Hillsborough River. Originally this area was inundated periodically by the projected 25 year flood. This levee will affect all of the wetland communities in the patterned area in varying degrees. These wetlands are adapted to periodic inundation, much of which is caused by rainfall, as in the case of the cypress domes, or by surface water flow, as in the case of riverine forests located in the floodplain. Proportionately, those areas that will be most affected will be the larger wetlands areas located here. A reduction in surface water and possibly ground water will put these areas under drought conditions which will be especially stressful during the dry winter months. Some water will be retained in the soil due to the soil characteristics in these wetlands but a large portion of these areas will be unable to support the current stands of aquatic vegetation. Terrestrial plants will quickly invade these areas and thereby change the entire composition of these habitats. This process of successional change will be accelerated should a fire enter these wetlands. Not only would fire directly kill the susceptible hardwoods but it would also remove the accumulated organic substrate or peat which is necessary for germination and establishment of many wetland herbs, shrubs, and trees.

Changes in Wetlands Resulting from the Cypress Creek Levee

Following the development of the levee, proposed by the Deltona DRI for Tampa Palms, an additional 385 acres of Category A wetlands would be modified and become Category B wetlands (Table 3-1). These changes in wetlands, result primarily from the shift of flood stage to above projected 25 year levels.

Figure 3-1 illustrates the portion of the proposed site which would be affected by the establishment of the Cypress Creek levee. This levee would prevent flooding over much of the area east of the levee to S.R. 581, which bisects the site from the southwest corner to the northeast corner. This action would affect most of the wetlands on this portion of the site, with the exception of the riverine forest along Cypress Creek and a dozen isolated wetland communities in the extreme northwest corner of the site. The primary wetlands affected would be cypress stands and domes. The larger stands are parts of a drainage area which flows westward into Cypress Creek. The smaller, circular wetlands are cypress domes and freshwater marshes that are not directly connected in a drainage pattern. The levee would modify the area to the extent that water within the wetlands would be reduced favoring the invasion of terrestrial herbs, shrubs, and trees. Only those areas which contain clay hardpans and can retain water available from rainfall would be able to maintain wetland communities. This would include the central portions of a few of the cypress domes and marshes but few of the cypress strands would retain adequate water to maintain normal growth requirements.

Summary of Ecological Impacts of Development at Tampa Palms Site

The indirect ecological effects of sewering the Tampa Palms site include rapid societal development of the area. Using the Deltona ADA for the proposed Tampa Palms development, the quantifiable impacts to wetlands in this area would result from construction of the Cypress Creek levee and direct loss of wetlands by construction of houses and other facilities on site. In addition, some reduction in quality of wetlands would arise from increased approximation of societal activities to wetlands.

The proposed Cypress Creek levee would reduce 385 acres of wetlands from Category A to Category B, based primarily on changes in projected 25 year flood areas. The establishment of a levee alters surface water flow to the extent that periodic flooding is controlled and/or prevented. Any wetland community located within the flood control area would be affected since wetlands depend upon periodic inundation, much of which comes from flooding. The riverine forests west and south of the study area have extensive floodplains associated with them. A reduction in water flow here would probably eliminate the inundation of much of the floodplain except during times of very heavy and frequent rainfall. The effect of this water reduction would be drying of soils making conditions unsuitable for aquatic plants and animals. Normal succession would include the invasion of terrestrial plants and animals from adjacent habitats into the former wetlands.

Accumulations of organic matter in the form of peat also play an important role in the ecology of cypress domes. Flood control would reduce the water retention capacity of these domes and expose the peat layers to drying and the resultant oxidation of organic matter. The periodic fires which occur here would destroy plant roots previously protected by moisture. The burned soils would become nutritionally sterile and be able to support only the more primitive invasion plants.

The animal communities normally found in these wetland habitats would also be unable to live in this altered environment. They would be displaced by species preadapted for dry soils and the less motile aquatic species would die. This would lower the overall diversity of the area's biotic communities. Several threatened or endangered animal species would be displaced by a reduction in wetland habitat, a primary reason many of them are currently threatened with extinction. Those animals that could relocate in adjacent wetlands would place additional stress on the present population and on the ability of these habitats to support these sensitive species.

In addition to the reduction in wetland-associated plants and animals in the affected area, other long term effects would occur. Wetlands are extremely important in the nutrient balance of an area. Available nutrients are sparse in the generally sterile soil types found in this region. Nutrients are more easily retained in the organic soils formed by wetland communities. Overland flow during periods of high water and seepage at other times helps distribute these nutrients to adjacent areas thereby affecting productivity outside the immediate perimeter of the wetland. A loss of this overland distribution would limit nutrient relocation and thereby reduce the area's ability to produce food crops, pasture grasses for livestock production, and the production of timber products. Therefore, the productivity of the entire area would be reduced to some extent.

Based upon the Deltona ADA, 294 acres of wetlands would be directly impacted by the proposed development. This would include 162 acres of cypress forest, 99 acres of fresh water marsh, 30 acres of mixed wetlands forests, and 3 acres of freshwater swamps. Using the quality criteria presented in the ADA, these development impacts would include part of 269 acres of high quality wetlands.

The less predictable impacts of development on this site are the changes in wetlands resulting from human activities in the area of otherwise undisturbed wetlands. These include impacts on biota resultant from decrease in air quality, increase in noise, and human encroachment into wetlands for recreational purposes.

3.3.2 Trout Creek (= New Town) Site

Wetlands Prior to Development

Approximately 1153 acres of wetlands are presently found on the Trout Creek site (Table 3-1). Wetland communities which occur on this site are illustrated in Figure 3-2 and can be classified as either riverine forest, cypress forest or dome, or freshwater marsh. The riverine forest community is found within the floodplains associated with Trout Creek and Clay Creek. The dominant tree species along Trout Creek are Carolina ash, laurel oak, and bald cypress. This association indicates that these are areas of frequent or permanent inundation. The Clay Creek drainage area is dominated by pond cypress, swamp tupelo, and slash pine. Cypress and tupelo are the dominate hydric species here, while the slash pine occurs on higher ground. Only 20 acres of wetlands on this site are considered in Cateogry C, primarily resultant from wetlands coincident with managed rights-of-way. No plans for wetlands modification are likely at this time and, therefore, no Category B wetlands are present on this site.

The cypress forest or dome is the most common wetland community on the site. It occurs as isolated stands of cypress growing in depressions and as cypress dominated stands growing in connected sloughs and drainage patterns. Several hardwood species such as red maple and American elm also occur here along with wax myrtle and sabal palm which are found on the drier portions of the slough. The freshwater marsh is a non-forested wetland which also occurs sporadically over the site. This community is found in permanent bodies of water formed in depressions.

Ecological Impacts of Development

The primary action from development at Trout Creek which would have the greatest effect on wetlands (aside from direct destruction during construction) would be the proposed excavation, according to the ADA, around several of the major cypress strands, cypress heads, and freshwater marshes. This action would presumably result in a more stabilized water level in these areas and counteract surface water flow. The stabilization of the water level in these areas would have a detrimental effect on the wetland biota. These aquatic communities are adapted to and depend upon periodic fluctuations in water levels. Seed germination for such species as cypress, tupelo, slash pine, and most understory woody species is dependent upon the presence of dry conditions during the appropriate season. Constant inundation would eliminate reproduction of a majority of the dominant woody plants. Additionally, the nutrient balance would be affected because of a cessation of interaction with adjacent communities. Important nutrients are carried from the wetlands into nearby areas during flood periods. The periodic fires which occur during the drier seasons would be excluded from the stabilized areas. This could have long term effects on the vegetative composition here as well as exclude certain wildlife species that are better able to utilize burned areas.

Another effect of excavation along the perimeters of the wetlands would be a probable shift towards a more monotypic community. This would be especially true in the freshwater marsh where only those species adapted to established water depths would persist, such as maidencane in shallow water or water lily and hyacinth in deep water. Constant inundation would favor cypress over the associated hardwood species but, since reproduction of cypress would be eliminated, the result would be a near even aged stand of this species. Monotypic communities are less stable and are more susceptible to destruction from outside agents and stresses. Communities of this type are decidedly less attractive to animal populations because only those animals who utilize only one plant type can exist here. Therefore animal as well as plant productivity and diversity would be drastically reduced by this action.

3.4 Northeast Sector Study Area

3.4.1 General Description

This area is located northeast of Tampa near the Hillsborough River. This river comprises much of the western and southwestern boundaries of this area and Morris Bridge Road and U.S. 301 make up the eastern boundary of the site (Figure 3-3).

Much of the natural vegetation in this area has been cleared for residential or industrial development while agricultural areas, primarily citrus groves, occupy much of the central portion of the site. Nautral communities found here include the riverine forests along the Hillsborough River and Cow House Creek, scattered cypress forests, freshwater marshes, upland communities, such as pine flatwoods, cleared rangeland and pastures, and dry, sandhill communities.

3.4.2 Wetlands in the Study Area

Wetlands Prior to Development

Approximately 1097 acres of wetlands presently occur in this area, of which 132 acres have already been reduced to Category C wetlands as a result of human activities (Table 3-1 and Figure 3-3). The dominant wetland community in this area is an extensive riverine forest within the Hillsborough River floodplain. Much of the original forest has been cleared for development but those areas that remain in a natural state are vegetated with cypress and hardwood species such as tupelo, Carolina ash, red maple, and sweetgum. Thick bayhead communities also occur here where the dominant species are sweet bay, redbay, and loblolly bay. The drier fringe areas contain waxmyrtle, gallberry, cabbage palm, and slash pine.

Wetland communities which are not part of this riverine forest are cypress forests or domes and freshwater marshes. Cypress forests are found in the northern and southern portions of this area where the flat topography allows the development of sloughs and wet depressions. Cypress are strongly dominant in these areas of frequent or permanent inundation while slightly higher hummocks are vegetated with red maple and American elm.

Ecological Impacts of Development

There are several wetland areas which have been altered by recent human activities. The most obvious impacts are on those communities adjacent to or crossed by highways or railroad and transmission line rights-of-way. In addition, a large wetlands area west of U.S. 301, just north of Sligh Avenue, has recently been cleared and drained for development as an industrial park.

Some areas of significant, long term secondary impacts would result from residential, industrial, or agricultural development made possible by sewering this area. Land clearing, draining, and filling would be the most obvious impacts to these wetlands. The most sensitive wetlands throughout this study area would be those adjacent to the Hillsborough River and Cow House Creek habitats. Much of this riverine forests area has already been developed, particularly near Sligh Avenue. Since sewering of the northeast sector site is not proposed until 1990-1995, additional societal activities in this area will probably reduce considerably the extent of Category A wetlands remaining at that time.

3.5 Summary

The three sites included in this study comprise approximately 4190 acres of undeveloped wetlands. Approximately 3923 acres, or 94 percent, of these hydric habitats are considered to be Category A wetlands based on hydrologic regime, size, and diversity of habitats offered. Of the remaining 267 acres, 99 acres are transitional, or Category B, wetlands based on projected changes in 25 year flood stages from the LHFDA project, and 148 acres are low quality, or Category C, wetlands, primarily as a result of human activities.

Although the study areas presently contain large tracts of important, forested wetlands, the prospects for development in some of these areas is high - particularly on the Tampa Palms site, where an active development plan is being considered, and in the northeast sector, where alteration of wetlands for industrial and residential development is ongoing. Although the direct effects of sewering are likely to be minimal in most of these areas, long term, indirect impacts caused by rapid societal expansion into these areas may result in large losses of important wildlife habitats and reduction in the wetlands available for water quality enhancement along drainage leading to the Hillsborough River.

The alternative of not sewering in these areas, may afford only a temporary delay in human impacts on these wetlands. Gradual encroachment on wetlands in these areas is likely to occur regardless of availability of wastewater treatment facilities. Unplanned development over the next 20 years, therefore, could result in more significant impacts on wetlands than would occur by planned communities where open space and hydrology have been considered.

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